COMMONWEALTH MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXIX APRIL 1950

ROLAND (G.) & FAGEL (G.). **Contribution à l'étude de la transmission du virus Y (Solanum virus 2, Orton).** [Contribution to the study of the transmission of virus Y (*Solanum* virus 2, Orton).]—*Parasitica*, 5, 3, pp. 48–53, 1 pl., 1949. [Flemish summary.]

The results of greenhouse transmission experiments conducted at Gembloux, Belgium, from October to December, 1948, confirmed previous findings that potato virus Y is non-persistent in the vector, *Myzus persicae* [*R.A.M.*, 19, p. 562], as only insects which moved rapidly from one White Burley tobacco plant to another transmitted it. Consequently, only the winged aphids are considered to be effective vectors. When successive plants were colonized by viruliferous aphids at intervals of two minutes, 79 out of 215 became infected, the final ones in the series having just as much likelihood of being infected as the first. If the aphid is allowed to remain on the first plant for more than four minutes its ability to infect subsequent plants is greatly reduced. For successful laboratory transmissions the following directions are given. After fasting, the aphids should be allowed to feed for two minutes on infected tobacco plants and transferred in lots of five to healthy ones. If the number of available aphids is very limited, they can be released on several successive healthy plants for periods of two to four minutes. If potato plants are used as the virus source, the number of insects should be greater because of the lower virus concentration in this host.

TAKAHASHI (W. N.). **The effect of pH on the linear aggregation of Tobacco mosaic virus.**—*Amer. J. Bot.*, 36, 9, pp. 642–645, 6 figs., 6 graphs, 1949.

In work at the Division of Plant Pathology, University of California, the infectivity of tobacco mosaic virus [*R.A.M.*, 29, p. 127] (as tested in *Nicotiana glutinosa*) was found to be lower at pH 5·6 than at pH 7. Electron micrographs show considerable increase in long particles at the lower pH value, probably due to linear aggregation. The aggregation or disaggregation of virus particles is reversible by changing the pH. Length distribution graphs of the particles at pH 7 show two distinct peaks, the usual one about 300 mμ and another at 75 mμ.

LAL (K. N.) & TYAGI (R. S.). **Deficiency, favourable, and toxic effects of boron on Tobacco.**—*Amer. J. Bot.*, 36, 9, pp. 676–680, 1949.

The response of Harrison's Special tobacco seedlings to boron was studied at the Plant Physiology Laboratory, Benares Hindu University, India, in 1945 using water, nutrient sand, and soil cultures with boron concentrations ranging from 0 to 10 p.p.m. Boron deficiency [*R.A.M.*, 26, p. 359; 27, p. 201; 28, p. 424] in water cultures caused bleaching of the leaves from the base upwards and yellowish, intervenal spots with white centres; these were more prominent in mature leaves. Prolonged deficiency resulted in the development of white, leathery leaf margins and yellowish centres. Veins remained green for a long time. Growth was checked, stem tips

remaining under-developed. Toxicity symptoms were observed in all cultures containing more than 1 p.p.m. boron. Brownish spots appeared which coalesced and dried out. Low boron concentrations (0·5 to 1 p.p.m.) somewhat improved the growth and vigour of tobacco plants.

McKay (R.). **Tomato diseases.**—107 pp., 22 pl. (1 col.), Dublin, At The Sign of the Three Candles, 1949. 21*s*.

This book, containing a clear and concise account of tomato diseases, is written to help the grower in Eire in identification and control. Twelve fungus, two bacterial, seven virus, and 15 non-parasitic diseases are dealt with. *Spongospora subterranea* attacks the roots of tomato plants, causing galls which vary in size and may be very numerous. They are at first white and smooth but are seldom noticed until the plants are pulled up, when they are brown and rough or corky. The disease does not appear to interfere with the cropping of the plant. Bacterial canker (*Corynebacterium michiganense*) was first reported for the country in June 1947, and in 1948 [cf. *R.A.M.*, 28, p. 346] 59 outbreaks were recorded. Of the virus diseases on tomato [ibid., 20, p. 430] common mosaic (tobacco mosaic virus) has not so far been isolated from diseased plants in Eire. Single virus streak (*Lycopersicum* virus 1) [? strain of tobacco mosaic virus] is still the commonest virus in the country. Enation mosaic (*Nicotiana* virus 1A) [a strain of tobacco mosaic virus] has occurred spasmodically in outdoor crops. Double-virus streak (potato virus X plus strains of tobacco mosaic virus) is the most injurious virus disease; in a new glasshouse, cropped with tomatoes for the first time, 30 per cent. severe necrosis developed as a result of using infected potatoes as wireworm traps. Non-parasitic diseases are divided into three groups: damage caused by unfavourable environmental conditions, malnutrition (mineral deficiencies), and chemical injury; they include blue or purple discoloration of seedlings and young plants, sun scorch and scald, flower drop and dry set, blossom-end rot, cracked fruits, greenback [ibid., 20, p. 437], blotchy ripening, rolling of foliage, and intumescences and oedema or dropsy.

Atkinson (J. D.), Brien (R. M.), Chamberlain (E. E.), Cottier (W.), Jacks (H.), Reid (W. D.), & Taylor (G. G.). **Tomato diseases and pests in New Zealand and their control.**—*Inf. Ser. Dep. sci. industr. Res., N.Z.* 2, 112 pp., 89 figs., 1949. 2*s*. 6*d*.

The symptoms, causes, factors favouring infection and spread, and control of the common diseases of tomatoes in New Zealand [*R.A.M.*, 28, p. 37] are described. The text comprises seven major sections dealing, respectively, with fungal, bacterial, virus, and physiological diseases, insect pests, control measures, and soil disinfection. An additional section by G. H. Cunningham is devoted to the certification of therapeutants, in which a tabulated list is given of such materials, showing the trade names, manufacturers or agents, purpose, and dosage. The work concludes with a key to the identification of the diseases according to the symptoms.

Vasudeva (R. S.), Garga (R. P.), & Azad (R. N.). **Necrosis in Tomato (Lycopersicon esculentum Mill.)**—*Curr. Sci.*, 18, 11, pp. 411–412, 2 figs., 1949.

In tests conducted at Delhi during February and March, 1949, Sutton's Early Market tomato plants, inoculated with leaf extract from potato plants with severe crinkling and mottling, consistently developed veinal necrosis and necrotic spots. The disease was readily reproduced by sap inoculation of healthy tomato plants. The first symptom was a slight inward rolling of leaf margins 20 to 22 days after inoculation, followed by the necrotic symptoms. Necrotic streaks were also produced on the petioles. The infected plants were dwarfed and tended to shed their leaves. The disease was transmitted by mechanical inoculation from tomato to tobacco, *Datura stramonium*, *Solanum nodiflorum*, and *Petunia hybrida*. The

reactions on these differential hosts indicated that the necrosis was caused by *Solanum* viruses 1 and 2 [potato viruses X and Y: *R.A.M.*, 28, p. 115].

Panos (N.). **Contribution à l'étude de l'expansion de quelques virus inoculables mécaniquement chez la Tomate.** [A contribution to the study of the extension of certain viruses susceptible of mechanical inoculation into Tomato.]—*Ann. Épiphyt.*, N.S., 14 (*Sér. Path. vég. Mém. 7*), pp. 297–314, 5 figs., 1948. [Received November, 1949.]

After briefly reviewing earlier investigations into the movement within the host of viruses which can be transmitted by mechanical inoculation [cf. *R.A.M.*, 13, pp. 476, 660; 19, p. 619; 27, p. 112] the author describes experiments carried out at the Plant Pathology Station, Versailles, in which Bonny Best and Marshal Joffre tomato plants about 20 cm. high were inoculated in the third leaf with tobacco mosaic virus, or potato virus X, or a complex of the two, using carborundum.

The virus movement beyond the inoculated leaf did not become evident until at least three days after inoculation, the period varying with the virus. Once the virus begins to move, it travels rapidly; in young tomato plants the disease becomes generalized in seven to ten days. Under identical conditions tobacco mosaic virus becomes generalized more rapidly than potato virus X. This also applies when both viruses infect one plant simultaneously. Under the experimental conditions the concentration of virus used appeared to have no effect on rate of spread. The apex of the plant and the root appeared to become infected by tobacco mosaic virus independently of each other and at about the same time. Cutting into the phloem but leaving the parenchyma unbroken slowed down but did not arrest virus movement. The part played by the internal phloem and other parts of the central cylinder in the rapid spread of tobacco mosaic virus is negligible. Annular decortication reaching the wood above the inoculated leaf thus breaking the external phloem totally arrested the spread of tobacco mosaic virus. Further work is necessary to confirm this, but it appears that spread takes place only through the parts outside the wood.

Capoor (S. P.). **The movement of Tobacco mosaic viruses and Potato virus X through Tomato plants.**—*Ann. appl. Biol.*, 36, 3, pp. 307–319, 2 figs., 1949.

Studies at Rothamsted Experimental Station are described which showed that tomato aucuba mosaic (tobacco mosaic) virus, ordinary tobacco mosaic virus, and potato virus X required 3·5 to 4, 5, and 3 days, respectively, to move from inoculated terminal leaflets of Kondine Red tomato plants into the petioles and stems [*R.A.M.*, 28, p. 209; and preceding abstract]. On reaching the stem, each virus usually moved downwards first, sometimes upward and downward movement occurred simultaneously, while in a few plants it moved upwards first. All three viruses travelled through the stem at approximately the same rate, the minimal average being about 8 cm. per hour. Uninfected pieces of stem were found between infected pieces; the maximum lengths of stem through which virus particles appeared to have passed without causing infection were 44·5, 49, and 39 cm. for the three viruses, respectively.

These results confirm earlier observations by Holmes and Samuel that a delay occurs before tobacco mosaic virus passes from inoculated leaves into the petiole and stem [ibid., 10, p. 212; 13, p. 476], and demonstrate that this is true also of potato virus X; they also show that the incubation period differs with different viruses and with different strains of one virus. That intervening non-infected lengths of stem occur (though all sections become infected if the plant is left intact) strongly suggests that virus movement over long distances takes place as an erratic and separated dispersal of individual virus particles through the phloem to remote

parts of the plant. An appendix summarizes from the literature the reported rates of movement of various viruses in plants.

Blencowe (J. W.) & Caldwell (J.). **Aspermy—a new virus disease of the Tomato.** —*Ann. appl. Biol.*, 36, 3, pp. 320–326, 1 fig., 1949.

Further investigations are described into the virus disease of outdoor tomatoes recently reported from Devonshire [*R.A.M.*, 25, p. 477], for which the name 'aspermy' is suggested.

The incubation period in tomato and *Nicotiana glutinosa* plants is 18 to 21 days and 8 to 16 in tobacco. The symptoms are much reduced in glasshouse plants and in outdoor plants in summer. In tobacco the symptoms were a yellow mosaic on the young leaves which became less marked as they enlarged, and diffuse, chlorotic blotches on the inoculated leaves. Later a dark green blotching with discontinuous veinbanding developed, sometimes resembling a ring spot pattern. Decapitation of older plants resulted in a reappearance of the symptoms in the leaves of the axillary shoots. The first symptoms on *N. glutinosa* also appeared on the growing leaves, which were distorted, occasionally so much as to result in a strap-shaped structure; this was followed by dark green 'savoying' and sometimes by necrosis. The flower buds were distorted and the flowers abnormal. Inoculations from tobacco and *N. glutinosa* into tomato plants gave the symptoms usually seen on tomato.

No transmission between tomato plants or from tobacco to tomato was obtained with various aphid vectors of viruses or with unidentified aphids actively infesting a diseased tomato plant in the field, though *Myzus persicae* readily transmitted the virus from diseased to healthy tobacco. Spread in the field was sporadic, suggesting the activity of an insect vector. Sap inoculations and other experimental evidence demonstrated that the tomato virus had no recognizable effect on the formation of lesions by the cucumber mosaic virus.

The systemic symptoms produced in *N. glutinosa*, the absence of local lesions in the inoculated leaves of this plant, and the resistance of the virus to ageing *in vitro* and to heat [loc. cit.] indicate that it is not ordinary tobacco mosaic, tomato spotted wilt, or tomato bushy stunt. Its properties also distinguish it from tomato bunchy top. There seems to be no immunological relationship between the virus and known strains of cucumber mosaic, and inoculations into cucumber were unsuccessful. The virus is therefore regarded as new and is referred to as *Lycopersicon* virus no. 7, or the virus of 'aspermy' disease of tomatoes. Roguing tomato plants early in the season should help to keep the disease in check.

Molybdenum deficiency in glasshouse Tomatoes.—*Agric. Gaz. N.S.W.*, 60, 10, p. 526, 1949.

Molybdenum deficiency in glasshouse tomatoes [cf. *R.A.M.*, 28, p. 494] was recorded for the first time in a crop at Ermington (ten miles from Sydney), New South Wales. Three other cases have been reported in New South Wales in outdoor crops. The glasshouse soil was a heavy clay loam and when sodium molybdate was applied to the plants slight visible responses were evident and were confirmed by chemical tests of leaves of treated and untreated plants.

Lincoln (R. E.) & Cummins (G. B.). **Septoria blight resistance in the Tomato.**— *Phytopathology*, 39, 8, pp. 647–655, 2 figs., 1949.

At the Purdue University Agricultural Experiment Station, Indiana, 66 Plant Introduction accessions, representing four species of *Lycopersicon* besides *L. esculentum*, were tested for their reaction to *Septoria lycopersici* [cf. *R.A.M.*, 22, p. 502]. Resistance was found among certain collections of *L. glandulosum*, *L. hirsutum*, and *L. peruvianum*, but *L. pimpinellifolium*, like *L. esculentum*, proved uniformly susceptible.

Resistance in the material used in the Station programme for the development of resistance to the pathogen was derived from *L. hirsutum* P.I. 126445. It was inherited as a dominant single gene, apparently identical with the Se se factor for leaf spot resistance obtained by Andrus and Reynard from the Targinnie Red variety of *L. esculentum* [ibid., 24, p. 252]. The F_2 population of the cross between the commercial variety Rutgers and *L. peruvianum* P.I. 126944 also segregated for resistance to *S. lycopersici* on the basis of a monofactorial, dominant gene.

The breeding programme has progressed through six back-cross generations to the stage where desirable varietal selections can be made. However, resistance of the type thus obtained may be of merely temporary value in combating the leaf spot, since no selection in the advanced generations has yet shown a degree of resistance equal to that found in the resistant parent.

Gallegly (M. E.) & Walker (J. C.). **Plant nutrition in relation to disease development. V. Bacterial wilt of Tomato.**—*Amer. J. Bot.*, 36, 8, pp. 613–623, 2 figs., 3 diags., 3 graphs, 1949.

In a further study in this series [cf. *R.A.M.*, 27, p. 393] a third vascular pathogen of the tomato (*Pseudomonas* [*Xanthomonas*] *solanacearum*) was investigated at the University of Wisconsin. Bonny Best plants were grown in constant-drip sand cultures with concentrations 0·1, 0·5, 1, 2, and 3 times that of the basal salt solution (H) [loc. cit.], with low and high nitrogen, phosphorus, and potassium values and with the low phosphorus solution adjusted to low, medium, and high pH. The plants were inoculated after approximately 25 days' growth by dipping the washed roots in a concentrated suspension of the bacterial wilt organism [ibid., 27, p. 96].

During the summer with temperatures up to 33° C., wilt development in nutrient concentrations was greatest at 0·1H and decreased with an increase in salt concentration. During early spring and late autumn (23° to 26°) wilt increased with an increase in salt concentration up to 1H but decreased sharply with further increase. Results typical of the winter could be reproduced in summer by maintaining day length at 12 hours, while summer-type results were obtained in winter by increasing daylight to 18 hours. Variation in light intensity and sand culture temperature failed to alter the long-day disease curve.

During the summer, wilt development was higher with low potassium and less with high nitrogen than in the 1H solution, but during early spring it was lower at both high and low nitrogen levels, although only in the latter was it significantly lower than that in the basal solution. Disease development in the unbalanced solutions at 32° (summer temperature) sand temperature was lower at the high nitrogen level and increased with low nitrogen, while at 24° sand temperature the reverse was true. The two sand temperatures had no effect on disease development in the low potassium solution although it was reduced at low light intensity.

Wilting in the balanced solutions during summer was correlated with growth of the organism when 1 per cent. dextrose was added to the solution and in winter with plant growth and with growth of the bacterium when 1 per cent. dextrose and 1 per cent. peptone were added to the nutrient solutions. There were indications that low pH salt solution reduced disease development.

Nel (E. A.). **The Durbot Tomato variety.**—*Fmg S. Afr.*, 24, 284, pp. 473–474, 2 figs., 1949.

Tomato growers in the Transvaal lowveld suffer serious losses annually from *Fusarium* [*bulbigenum* var.] *lycopersici* [*R.A.M.*, 28, p. 364]. Races of the fungus differ widely in pathogenicity. While the most virulent ones cause direct wilting and rapid death, the less malignant forms cause slow degeneration. Successive yellowing of first the lower and then the upper leaves is followed by defoliation, stunted growth, and a considerable fruit reduction. For a number of years Marvel

[ibid., 13, p. 195] was the most resistant variety. Bohn and Tucker [ibid., 18, p. 766] supplied in 1940 one of their immune selections, 3–S–12, to the Durban Botanical Station, seed of which was sent in 1946 to the Nelspruit Research Station under the name Durbot, and from tests it appeared to be immune. Selections showed, however, that it did not breed true to type, but some progeny had a much higher degree of resistance than Marvel. Breeding work is being continued to obtain a true-breeding strain.

Miller (J. H.) & Thompson (G. E.). **Witches'-broom of Japanese Walnut in Georgia.**—*Plant Dis. Reptr*, 33, 12, p. 455, 1 pl., 1949. [Mimeographed.]

Of a collection of Japanese walnuts (*Juglans sieboldiana*) planted in three separate localities in Georgia about 25 or 30 years ago, one group developed witches' brooms [*R.A.M.*, 26, p. 362] in 1938, resulting in the death of the trees in 1944, while the other two groups developed the disease in 1947 and at present show complete systemic infections. A black walnut (*J. nigra*) and pecans growing near have developed no symptoms.

Darpoux (H.). **Le chancre du Châtaignier causé par l' 'Endothia parasitica'.** [Chestnut canker caused by *Endothia parasitica*.]—*Rev. tech. Prot. Vég.*, 1, 4, pp. 307–330, 4 pl., 9 figs., 1 diag., 2 maps, 1948. [Received November, 1949.]

A survey sponsored by the Institut National de la Recherche agronomique revealed that in April, 1948, chestnut blight (*Endothia parasitica*) [*R.A.M.*, 29, p. 129] was present at Caserte, north of Avellino near Parma and Modena, from Sezze into the province of Frosinone, and probably in eastern Sicily, near Catania, where withering has been observed. At Busalla, where the disease was first observed in 1938, only a few old trees covered with cankers remain. In the centre of an extensive chestnut plantation at Cutigliano [ibid., 27, p. 590] there was a localized focus of infection of 4 to 5 ha., in the centre of which 90 per cent. of the trees were dead. At Sezze the disease was confined to a few ha. of coppiced trees 15 to 20 years old, the interior of the infected zone being practically clear of trees while on the periphery most of them bore numerous cankers which frequently encircled the trunk.

Since the principal foci of infection adjoin the ports of Genoa, Trieste, and Naples, the disease may have been introduced in staked chestnut seedlings imported from America during the 1914–18 war when dead fructifications of *E. parasitica* were found on wood brought to England and Belgium by American troops. It is thought that the disappearance of trees in the mountain regions of Italy may be followed by a migration of the population to the plains and towns.

The American species of *Castanopsis* are very susceptible to *E. parasitica*, while the Asiatic species, such as *C. delavayi* and *C. hystrix*, are very resistant. In the United States the disease has been observed to cause slight damage to *Quercus alba*, *Q. rubra*, and *Q. velutina* and in Italy also to oaks (probably *Q. robur*). In the United States the fungus is saprophytic on *Ostrya virginiana*, *Acer rubrum* [ibid., 14, p. 800], *A. saccharum*, *A. palmatum*, *Rhus typhina*, and *Carya ovata* [ibid., 15, p. 400].

An experimental research centre has been set up at Modena for breeding resistant varieties and for hybridization [cf. ibid., 28, p. 428]. Meanwhile the chestnut must be replaced by other forest trees in the devastated areas. In Italy it is intended to replant with hazel nuts for export.

Toole (E. R.). **Fusarium wilt of Staghorn Sumac.**—*Phytopathology*, 39, 9, pp. 754–759, 2 figs., 1949.

Staghorn sumac (*Rhus typhina*), a source of tannin, an important game food plant, and a highly prized ornamental, is subject in Virginia and Connecticut to a

vascular wilt caused by *Fusarium oxysporum* f. *rhois* [*R.A.M.*, 28, p. 603]. The first external symptom of the disease is a wilting of some of the leaves, which hang sharply downwards from the twigs and may remain attached to the stem for some time. Generally the affected trees soon succumb, but in the more gradual forms of infection they may develop dwarfing, chlorosis, and premature autumn coloration. Sporodochia of the fungus are sometimes found in the lenticels on the bark of wilted trees growing in dense stands on damp sites. A more reliable diagnostic symptom of *Fusarium* infection than the wilting, which may be due to other causes, is a brown discoloration of the outer sapwood immediately underlying the bark, especially in the roots and lower part of the trunk. It is often unilateral and may extend upwards to the petiole and base of the fruit cluster, though there is no evidence of the transmission of the fungus through the seed.

F. oxysporum f. *rhois* was inoculated into its own host and three other species of *Rhus* and *Albizzia julibrissin* with positive results only on *R. typhina*, the divergent reactions of different plants of which suggest the possibility of selection and propagation of wilt-resistant clones.

CRANDALL (B. S.). **An epidemic vascular wilt disease of Barillo, Calophyllum brasiliense var. rekoi, in El Salvador.**—*Plant Dis. Reptr*, 33, 12, pp. 463–465, 1949. [Mimeographed.]

In May, 1949, barillo trees (*Calophyllum brasiliense* var. *rekoi*) at San Pedro Nonualco, El Salvador, valuable for their wood and as shade and street trees, were reported to be suffering heavy losses from a rapid-killing vascular wilt [cf. *R.A.M.*, 28, p. 651]. Of 500 trees in one locality 300 were found dying or dead, and it appeared that trees had been dying in widely separated areas for the previous two years.

Trees of all ages are being attacked. The first symptom is the wilting of leaves, which turn chlorotic, then brown and dry and die within four weeks. Internally, dark brown streaks develop in the vascular system of the normally cream-coloured wood, apparently due to the formation of a wound gum which clogs the vessels.

Cultures from streaked wood yielded an apparently undescribed species of *Cephalosporium*, similar to *C. diospyri* [ibid., 27, p. 503]. The pale yellow fungus grew slowly on artificial media, producing abundant spore heads on short stalks developing directly from the hyphae. Young trees inoculated with spores produced in pure culture developed typical wilting and internal symptoms after five weeks.

LARGE (J. R.). **Rough bark of Tung, a virus disease.**—*Phytopathology*, 39, 9, pp. 718–720, 1 fig., 1949.

Two tung (*Aleurites fordii*) trees with rough, black bark on the trunk and limbs and long, slender, twisted, willowy branches have been observed, one in Louisiana in 1945 and the other in Mississippi in 1946. A light bronze discoloration of the bark is followed by the development of small, widely spaced blisters on the surface; later the cortex darkens and cracks into small, irregularly shaped segments. The implantation of buds from diseased shoots into healthy rootstocks has induced rough bark in suckers developing both above and below the implanted bud. In the absence of other pathogenic organisms, the transmission of the disease in this manner indicates that a virus is implicated in its causation.

OECHSLIN (M.). **Bespritzungs- und Bestäubungsversuche gegen die Herpotrichia nigra. (Vorläufige Mitteilung).** [Spraying and dusting experiments against *Herpotrichia nigra*. (Preliminary note).]—*Schweiz. Z. Forstw.*, 100, 5, pp. 229–231, 1949.

Very encouraging results in the control of *Herpotrichia nigra* [*R.A.M.*, 27, p. 207] on young spruce trees in experimental plantings in Switzerland have been obtained

in preliminary tests by the application of copper-containing preparations, preferably in dust form, supplied by Ciba AG (Basle). Of 224 control trees inoculated in the autumn of 1946, 86 had contracted the disease by the following spring, whereas in two other plots treated with the copper dust at the time of inoculation the numbers of healthy and infected trees were 264 and 6 and 194 and 19, respectively.

DUNLAP (A. A.) & HARRISON (A. L.). **Dying of Live Oaks in Texas.**—*Phytopathology*, 39, 9, pp. 715–717, 1 fig., 1949.

Symptoms of live oak (*Quercus virginiana*) disease, which culminates in the more or less sudden death of these valuable shade trees in some 20 counties in central Texas (*Rep. Tex. agric. Exp. Sta.*, pp. 97–98, 1934; pp. 99–100, 1935), are a foliar chlorosis or mottling, sometimes accompanied by striate discoloration of the wood in the roots. Frequently the entire tree is affected, in which case it may die within a few weeks, but if only one branch is involved at a time, a season or two may elapse before death. No causal organism appears to be associated with the die-back, which occurs under a variety of environmental and seasonal conditions. Drastic pruning of the main branches, at the first sign of the disorder, has resulted in the apparently lasting recovery of the trees in a number of cases.

ROL. **Quelques maladies des arbres forestiers en 1948.** [Some diseases of forest trees in 1948.]—*C.R. Acad. Agric. Fr.*, 35, 4, pp. 119–121, 1949.

During 1948, plane trees [*Platanus* sp.] in Paris were attacked by *Gnomonia veneta* [*R.A.M.*, 27, p. 396], but after a month or two all recovered, except weak or recently planted trees. Nursery oaks were attacked by *Rosellinia quercina*. A red, foliar discoloration in a plantation of *Pinus excelsa* trees near the Lake of Geneva was followed a month later by the fructifications of *Hypoderma brachysporum* [*H. desmazierii*: ibid., 20, p. 614]. *Pucciniastrum abieti-chamaenerii* [ibid., 17, p. 571] occurred on fir trees [*Abies* spp.] in the central Pyrenees and *Cronartium asclepiadeum* [ibid., 26, p. 229] on Scots pine (*Pinus sylvestris*) in Sarthe. *C. ribicola* [ibid., 2, p. 49; 28, p. 653], although continuing to cause damage to Weymouth pine [*P. strobus*], does not appear to be increasing. Douglas fir (*Pseudotsuga taxifolia*) was attacked by *Phomopsis pseudotsugae* [ibid., 28, pp. 260, 429], seldom recorded in France.

Much more serious were losses caused by wilting of individual trees, including Scots pine, oak, and fir. Heavy losses of fir were reported in the Haut Var, chiefly in the valley of the Chabron, starting in 1945. Since then the condition has grown progressively worse, 50 to 60 per cent. of the trees being affected in certain forests, e.g., at Trigance. No parasite appeared to be present. Oaks in northern France have also wilted, and in 1948 the condition spread markedly, notably in Lorraine and the Loire valley.

FOSTER (H. H.), MUSSER (A. M.), HIGDON (R. J.), & HUGHES (M. B.). **Pecan scab spray experiments in South Carolina during 1948.**—*Plant Dis. Reptr*, 33, 12, pp. 466–470, 1949. [Mimeographed.]

This is the full account of experiments on the control of pecan scab (*Cladosporium effusum*), an abstract of which has already been noticed [*R.A.M.*, 28, p. 602].

BIRAGHI (A.). **Il disseccamento degli Abeti di Vallombrosa.** [The withering of the Firs of Vallombrosa.]—*Ital. for. mont.*, 4, 3, pp. 1–11, 6 pl., 1949.

In the spring of 1946, numerous individual *Abies pectinata* trees at Vallombrosa began to wilt, the condition gradually spreading and becoming worse. The first symptoms were a reddening of the needles at the extremities of the branches, the discoloration spreading towards the base; all the needles became affected and in a

few days the whole tree withered. At the base of affected trees up to about ten years of age there was a swelling about 10 to 15 cm. long with minute longitudinal cracks showing white wood inside with the mycelium of *Armillaria mellea*. Many of the trees so infected showed only slight reddening, with definite wilting of the aerial parts. This, apparently, is the first record of *A. mellea* attacking the stem of a tree directly and causing a swelling resembling a canker. Slightly older trees bore smaller cankers without cracks. The bark was covered in places with a violaceous-brown pellicle, while in others small masses of white mycelium were present. Higher up, a little above the first branches, which had already withered, a definite line could be seen between the dead and healthy cortical tissue. From affected material taken from the wood and the cortical tissue of these trees *Fomes annosus* was isolated. *A. mellea* was present in the roots, which were mostly dead or in a poor condition.

The smaller roots of dead adult trees were in an advanced stage of rotting. *F. annosus* was constantly isolated both from the roots and the base of the trunk. The main roots of adult trees in the initial stage of the wilt also contained *F. annosus*. Of the smaller roots, some were completely rotted, while others bore the rhizomorphs of *A. mellea*.

The evidence indicates that attack by *A. mellea* had preceded that by *F. annosus*. In 1923, firs in the same locality were also killed off by a wilt due to *A. mellea*. It is concluded that infection had been favoured by the prolonged drought of 1945 and by damage caused to the trees during military operations.

Siggers (P. V.). **Weather and outbreaks of the fusiform rust of southern Pines.**—*J. For.*, 47, 10, pp. 802–806, 1949.

A study of weather data from 1937 to 1940 in the south-east coastal States of Mississippi, Alabama, and Georgia indicated that warm weather in late winter and particularly in March induced favourable conditions for the development of the uredospore stage of the southern fusiform rust (*Cronartium fusiforme*) [*R.A.M.*, 27, p. 398] on oaks. Very warm weather in February and March, 1938, 56·1° F. mean (49·5° average mean) and 64·7° mean (57° average mean), respectively, followed by cool damp weather in April resulted in serious outbreaks of the disease in pine (*Pinus caribaea* and *P. taeda*) tree nurseries. Losses were least in 1937 when unusually cold weather in March delayed peak production of sporidia until May. Variations in rainfall in the first quarter of a year do not seem to influence the development of the uredospores. Peak production of teleutospores in the coastal States usually occurs from 15th April to the first week in May. Pines usually start seasonal growth in mid-April. The author suggests that nurserymen, with the aid of simple meteorological equipment and temperature records, could forecast the infection hazard by the latter part of March and apply control measures accordingly [ibid., 28, p. 604].

Zaleski (K.), Domański (S.), & Wojciechowski (E.). **Grzyby Państwowego nadleśnictwa Zielonka (woj. Poznańskie), zebrane w latach 1946 i 1947 r.** [Fungi of the Zielonka State forests (Poznań province), collected from 1946 to 1947.]—*Acta Soc. Bot. Polon.*, 19, 1, pp. 101–143, 1 map, 1948. [English summary.]

This list of Ascomycetes, Basidiomycetes, and Fungi Imperfecti collected during 1946–47 in the Zielonka State forests, Poland, contains 324 species, including three provisional new varieties, namely, *Lophodermium juniperinum* var. *minorospora* n. var. ad. int. and *Hendersonia foliicola* var. *logiorospora* n.var. ad. int. on *Juniperus communis*, and *Leptothyrium pinastri* var. *maiorospora* n. var. ad. int. on *Pinus strobus* and *P. sylvestris*.

Van Vloten (H.). **Kruisingsproeven met rassen van Melampsora larici-populina Klebahn.** [Hybridization experiments with races of *Melampsora larici-populina* Klebahn.]—*Tijdschr. PlZiekt.*, 55, 3, pp. 196–209, 2 figs., 1949. [English summary.]

A tabulated account is given of hybridization experiments carried out from 1939 to 1944 at the Wageningen Agricultural College with four physiologic races of *Melampsora larici-populina* [*R.A.M.*, 25, p. 145] designated, according to the colour of the aecidiospores and uredospores, C4 orange, C2 orange, C2 white (a mutant), and B22 orange. The poplars tested fall into three groups according to their reaction to the rust, namely, (1) uniformly susceptible to the four races, i.e., *Populus serotina*, *P. marilandica*, *P. robusta*, and *P. generosa*, and therefore useless for differential purposes; (2) *P. regenerata*, *P. eugenei*, and *P. gelrica*, resistant to C2 orange and C2 white which develop freely on the sole representative of (3), *P. candicans*, while the latter is resistant to B22 orange, a severe pathogen of group (2).

The crosses were made on larch and most were between C2 white, isolated from *P. candicans*, and B22 orange from × *P. gelrica*, × *P. eugenei*, or × *P. regenerata*. The colour-producing factor is dominant and the colourless recessive. Orange aecidio- and uredospores may be either homo- or heterozygous as regards colour. The seven F_1 hybrids proceeding from the crosses C2 white × B22 orange and C2 white × B15 orange inherited their colour from B22 and B15 parents but proved unable to develop on *P. gelrica* and *P. eugenei*, which are susceptible to the parental races. *P. candicans* was susceptible to four of the seven hybrids. The spores from the reciprocal cross B15 orange × C2 white inherited the colour of the B15 parent, but *P. eugenei*, susceptible to the latter, showed resistance to the hybrid. *P. candicans*, susceptible to the C2 parent, reacted similarly to the hybrid. The 'colourless' factor being recessive, the pycniospores of the white parent did not express the absence of colour, but they did determine the pathogenicity of the hybrid, which resembled that of the C2 parent. Similarly, the hybrid produced from B13 orange × C2 white owed its colour to the B13 parent and its pathogenicity to C2.

Some of the hybrids produced teleutosori on poplars in the greenhouse and could therefore be grown on larch again in the following spring. The F_2 from C2 white × B15 orange or × B22 orange produced orange and white pycnia. From caeomata (resulting from natural self-fertilization), some with orange spores and some with white, six white and five orange isolates were obtained and tested on poplar leaf disks in Petri dishes. Their pathogenicity proved to be identical with that of the C2 parent, *P. candicans* being susceptible while none of the isolates was able to develop on *P. eugenei*. One F_2 isolate with white aecidiospores from the reciprocal cross B22 orange × C2 white resembled the latter race, being pathogenic to *P. candicans* but not to any of the group 2 species.

The hybrid B13 orange × C2 white caused two isolated infections which formed white pycnia. Back-crossed with pycniospores of B13 orange, both developed an orange coloration. The F_1 generation had been able to grow on *P. candicans* but not on *P. regenerata* or *P. eugenei*. Thus, the F_1 hybrid had acquired its colour from B13 and its pathogenicity from C2. As regards the back-crosses, the pycnia of the hybrid parent showed the white character of C2, while their hybridization with B13 orange pycniospores resulted in orange-coloured aecidiospores with the pathogenic attributes of B13. Another isolated infection derived from germinating teleutospores of the hybrid C2 white × B22 orange, with orange pycnia, was back-crossed with C2 white. The orange factor being dominant, B22 also determined the colour of the F_2. However, the pathogenicity of the back-cross progeny was identical with that of C2, *P. candicans* being susceptible and *P. eugenei* and *P. gelrica* resistant.

Strains and races of *M. larici-populina* have been regularly reisolated from plantation and nursery poplars by keeping leaves bearing teleutospores separately. By this method a new white variant of the rust was isolated in 1944 from $\times$*P. eugenei* $\times$ *P. regenerata* and also from a specimen of the latter species. Differing in pathogenicity from C2 white, it might be supposed to represent the F_2 of a hybrid between C2 white and B22 orange. Another plausible explanation of its appearance is afforded by the recessive character of the white factor, which may have been present in B22 orange but suppressed by the dominant colour factor. The remote probability of a combination between the recessive white factors may have been realized in 1944.

The reisolation of *M. larici-populina* after hybridization involved difficulties in the study of certain aspects of the specific susceptibility problem. This method favours the development of new races and the disappearance or alteration of others. For instance, prior to and during 1943, *P. regenerata* had been resistant to C2 orange and C2 white, whereas in 1944 it was susceptible to both races.

Millard (P.). **Le Mélèze du Japon.** [The Japanese Larch.]—*Bull. Soc. for. Belg.*, 56, 10, pp. 377–382, 1949.

During autumn, 1945, an attack of *Armillaria mellea* [*R.A.M.*, 25, p. 482] occurred in a plantation of Japanese larches [*Larix leptolepis*] in Belgium, on light, dry soil after spruces badly attacked by an [unspecified] red rot had been cleared away. It is advised that larches should be planted only in soil types most suited to them. The author has not encountered any Japanese larches attacked by canker (*Dasyscypha willkommii*) in Belgium. One 32-year-old plantation is free from canker although a neighbouring one of European larch planted at the same time was destroyed by the disease when 15 years old.

Campbell (W. A.). **Relative abundance of Phytophthora cinnamomi in the root zones of healthy and littleleaf-diseased Shortleaf Pine.**—*Phytopathology*, 39, 9, pp. 752–753, 1949.

By means of a method involving the use of apples for the selective isolation of *Phytophthora cinnamomi*, soil was assayed near Athens, Georgia, under (*a*) 20 healthy shortleaf pine (*Pinus echinata*) trees on sites free from little leaf [*R.A.M.*, 28, p. 366, and next abstract], (*b*) 20 healthy trees on little leaf sites, and (*c*) 20 affected by the disease in a typical or advanced form. Soil samples (24 to a depth of 5 to 6 in. under each tree) were removed during December, 1948, and January and February, 1949, when the weather was comparatively mild except for two cold spells of brief duration. The ages of the trees ranged from 20 to 60 years. The data indicate that *P. cinnamomi* is involved in the fine root necrosis known to accompany the disease.

Jackson (L. W. R.) & Zak (B.). **Grafting methods used in studies of the littleleaf disease of Shortleaf Pine.**—*J. For.*, 47, 11, pp. 904–908, 3 figs., 1949.

From 1941 to 1947 experiments were carried out at Athens, Georgia, to determine whether the little leaf disease of shortleaf pines (*Pinus echinata*) [see preceding abstract] is of virus origin and transmissible by grafting. Both the above-ground parts and the roots of shortleaf pines with little leaf were successfully grafted on to healthy seedlings, saplings, and adult trees. So far, however, the healthy, grafted trees have not developed symptoms of the disease.

True (R. P.) & Snow (A. G.). **Gum flow from turpentine Pines inoculated with the pitch-canker Fusarium.**—*J. For.*, 47, 11, pp. 894–899, 2 figs., 20 graphs, 1949.

In a punch-wound test carried out at Lake City, Florida, in 1946, inoculation of slash and longleaf pines (*Pinus caribaea* and *P. palustris*) with Florida isolates of

the pitch-canker fungus, *Fusarium lateritium* f. *pini* [*R.A.M.*, 28, p. 603] resulted in a considerably longer gum flow than from uninoculated, wounded controls or those treated with sulphuric acid. In 1947 and 1948 tests were undertaken with regular turpentine faces and other wounds. A filtered suspension of mixed spores and mycelium was sprayed to cover completely all portions of the wood and inner bark exposed by the wound. The results showed that the inoculations prolonged the period of commercially adequate gum flow (normally one week) to an average of five weeks for slash pine and three weeks for longleaf pine. Later rechipping with inoculation of the same faces prolonged adequate flow for an average of three weeks from the former and for usually not more than two weeks from the latter. Further investigations are necessary to ascertain the commercial value of the fungus as a gum flow stimulant. It spreads so slowly and to such a limited extent that it seems to offer little or no threat to the health of the tree when used in this way.

Allegri (E.) & Morandini (R.). **Prime notizie sui risultati in Italia delle esperienze internazionali sulle razze del Pino sylvestre.** [Preliminary results in Italy of international researches on the races of *Pinus sylvestris*.]—*Ann. Sper. agr.*, 3, 4, pp. 993–1027, 31 graphs, 1 map, 1949. [English summary.]

In this article, which summarizes the first ten years' data compiled at the Italian Forestry Experiment Station, Florence, on the growth of various races of Scots pine (*Pinus sylvestris*), it is reported that in the spring of 1948 four withered trees in experimental plots at Brenna and three at Alzate had been attacked by root rot (*Armillaria mellea*). Owing to the insignificance of fungus attacks so far, however, it is impossible to judge the relative resistance of the various races.

Buchanan (T. S.). **Poria weirii : its occurrence and behaviour on species other than Cedars.**—*Northw. Sci., Wash.*, 22, 1, pp. 7–12, 1948.

Investigations and observations made during recent years have significantly altered previous concepts of *Poria weirii* [*R.A.M.*, 28, p. 441] host relationships. The fungus is now known to occur in a destructive form on Douglas fir (*Pseudotsuga taxifolia*) of all age classes from Vancouver Island, British Columbia, at least as far south as Coos County, Oregon. Losses may be due to the killing effects of the pathogen as a root rot, enhanced susceptibility to wind-throw, or decay of the heartwood. *Poria weirii* also attacks western hemlock (*Tsuga heterophylla*), and D. C. Buckland (Dominion Laboratory of Forest Pathology, Victoria, B.C.) lists (*in litt.*) as additional hosts [ibid., 26, p. 432] *A. grandis* and *A. lasiocarpa*. Evidence is also forthcoming that the fungus is not the all-important cause of decay in western red cedar [*Thuja plicata*] that it was once assumed to be.

Griffioen (K.). **Some wood-destroying fungi of Indonesia.**—*Rapp. Bosb. Proefst., Buitenz.* 1, 16 pp., 1948, (English edition). [Received December, 1949. Mimeographed.]

This paper is a revised, English edition of a series of service records of investigations started in 1940 in the laboratory of the Forest Research Institute, Indonesia, concerning wood-destroying fungi in Indonesia. The method used was that of Waterman *et al.* [*R.A.M.*, 17, p. 785]. The fungi used for the test included *Polystictus hirsutus*, *P. sanguineus*, *Lentinus sajor-caju*, *Polyporus cervino-gilvus*, and *Guepinia spathularia* [ibid., 22, p. 118]. Timbers of 14 different species, all rather perishable except teak, were tested for a period of five months with *Polystictus hirsutus*. It is one of the most dangerous wood-destroyers in the area. The decay is very great, whether the blocks are very wet, moderately wet, or very dry. *Dalbergia latifolia* and *Vatica teysmanniana* were not attacked, teak only slightly, and *Palaquium burkii* and mahogany (*Swietenia macrophylla*) appeared outwardly sound although

they lost 20 per cent. dry weight. *P. sanguineus* [ibid., 25, p. 589] was quick-growing and a very severe wood-destroyer on seven timbers tested. It can tolerate large fluctuations in the water content but it seems that the fungus is sooner checked by a deficit than by an excess of water. The moisture content of the wood blocks on which *L. sajor-caju* was growing was very low except for kemiri (*Aleurites moluccana*). Sporophores formed very easily. Kemiri was seriously decayed by *P. cervino-gilvus* but damar (*Agathis dammara*) had not suffered any attack and that on *Albizzia falcata* was insignificant. It is possible that this fungus does not attack soft woods. *G. spathularia* is a slow-growing fungus causing moderate decay and superficial discoloration of the wood of five species, but teak and damar were not attacked or stained.

Hirt (R. R.). **Control of wood decay by certain brushed-on preservatives.** -116 pp., 6 figs., New York State College of Forestry, [? 1949].

In this booklet the author discusses the value of brushed-on wood preservatives [*R.A.M.*, 29, p. 69] and gives the results of studies made at the New York State College of Forestry, Syracuse University, to compare several new preservatives on a variety of timbers placed subsequently on damp soil or in contact with decayed wood. Copper naphthenate [ibid., 29, p. 1] was the most effective protectant in the first case, followed by creosote and zinc naphthenate. In the second, creosote prevented decay best with the naphthenate next in order of effectiveness. Because brushed-on preservatives do not penetrate the wood very deeply a second coat is considered worthwhile. Only sound, dry wood should be treated, individual timbers being covered before they are assembled. Soaking the timbers for three to five minutes in a wood preservative should give better protection than brushing, although brushing is valuable because of the simplicity of application and the appreciable degree of protection it gives. Wooden structures which can be given longer life by brushing on suitable preservatives are cited and the trade names and source of supply of a number of preservatives given [cf. ibid., 26, p. 38].

King (E. E.). **Non-pressure treatments of round Northern White Cedar timbers with creosote. A report of an investigation conducted by the Engineering Experiment Station, University of Illinois.**—*Bull. Ill. Engng Exp. Sta.* 379, 62 pp., 6 figs., 6 graphs, 2 diags., 1948. [Received November, 1949.]

Fully tabulated results are given of tests carried out in Illinois to determine the effect of various non-pressure processes commonly used in the creosote treatment of timber in extending the life of northern white cedar (*Thuja occidentalis*) [*R.A.M.*, 27, p. 209] posts and poles exposed to [unspecified] agencies of decay. Some of the timbers were incised before treatment. The test specimens, approximately 42 in. long, were treated in the summers of 1922 and 1923 with a special grade of carbolineum creosote oil with a higher boiling point than ordinary creosote, and set $2\frac{1}{2}$ ft. in the ground in an unprotected position for 20 years.

The results obtained demonstrated that steeping for periods up to seven hours and double-tank (hot and cold) treatment were more effective than the more superficial methods of brushing or dipping (one to three immersions for 5 to 15 minutes) in causing the preservatives to enter the wood. Degree of penetration was affected by duration of immersion and temperature of the preservative, and by the moisture content and sapwood thickness. Almost all the incised timbers that received steeping or tank treatment were still sound after 20 years. Incisions increased the absorption of the preservative oil, but for longer periods of absorption the increases were smaller. However, the additional increment of absorption and the superior uniformity of surface penetration would appear to justify commercially the expense of making incisions where replacements would be expensive and difficult.

Raphael (H. J.). **The influence of depth of immersion on end penetration in Douglas Fir heartwood when cold-soaked in pentachlorophenol.**—*J. For.*, 48, 1, p. 49, 1950.

It is stated in this abstract of a thesis presented at the Oregon State College School of Forestry that in immersion tests on kiln-dried, heartwood samples of Douglas fir [*Pseudotsuga taxifolia*: cf. *R.A.M.*, 29, p. 4] soaked for 30 minutes in a pentachlorophenol–diesel oil solution at various depths, it was found that increasing the depth up to 10 ft. secured better penetration, and such treatment appears justified.

Coombes (G. A. N.) & Julien (J. H.). **The production of vegetable seeds in Mauritius (1943–1946).** —*Bull. Dep. Agric. Mauritius* 50, 38 pp., 1949.

This paper reports the results of a vegetable seed production scheme started in Mauritius in 1943 and the best culture methods are described. The principal diseases and pests encountered are mentioned [cf. *R.A.M.*, 28, p. 472]. The 'Haricot filant' variety of runner bean (*Phaseolus multiflorus*) suffered from the same diseases as dwarf bean (*P. vulgaris*) among which collar rot (*Phytophthora* sp.), which also occurs on peas, may be noted. Some of the desirable dwarf bean varieties were very susceptible to anthracnose (*Colletotrichum lindemuthianum*); Local Red proved fairly resistant. Lettuce mosaic [ibid., 28, p. 503] was observed at Reduit and Beau Bassin. Leaf spots of Chinese cabbage were caused by *Colletotrichum* sp. and *Macrosporium* [? *Alternaria*] sp. This vegetable is highly susceptible to soft rot (*Bacterium carotovorum* [*Erwinia carotovora*]). *A. oleracea* [*A. brassicicola*] causing inflorescence blight is the chief disease of cauliflower and may cause a total loss of the seed crop. *Cercospora* sp. and *Macrosporium* [? *Alternaria*] sp. caused blight of carrot which may be controlled by an application of Burgundy mixture every ten days. Diseases of Chinese radish were leaf spot (*Cercospora* sp.) and soft rot [*E. carotovora*]. Tables are given summarizing the results obtained.

Rose (R. C.). **How to control soil- and seed-borne diseases of vegetables.**—*Ext. Fold. Minn. agric. Ext. Serv.* 139, 5 pp., 3 figs., 1946. [Received 1949.]

A table summarizes the seed treatments recommended against the chief seed- and soil-borne fungal diseases of vegetables in Minnesota, and notes are given on steam and chemical soil treatments.

Calvert (O. H.), Pound (G. S.), Walker (J. C.), Stahmann (M. A.), & Stauffer (J. F.). **Induced variability in Phoma lingam.**—*J. agric. Res.*, 78, 12, pp. 571–588, 4 figs., 2 graphs, 1949.

A preliminary account of these studies on *Phoma lingam* from cabbage has already been noticed from another source [*R.A.M.*, 28, p. 609].

Coons (G. H.). **The Sugar Beet : product of science.**—*Sci. Mon., N.Y.*, 68, 3, pp. 149–164, 12 figs., 1949.

In this interesting and comprehensive study of the sugar beet in the United States, the author deals *inter alia* with epidemic diseases and breeding for disease resistance. The most destructive diseases are curly top [*R.A.M.*, 28, p. 611] and leaf spot (*Cercospora beticola*) [ibid., 28, p. 613], the latter reducing tonnage and sucrose content enough to make the crop unprofitable. Outbreaks occur when the early part of the season has frequent rainy periods and total precipitation is abundant. In such years the entire foliage rosette may be killed several times in the growing season; new growth is blighted in two or three weeks, and the replacement greatly reduces root growth and sugar content. In the period 1915–30 epiphytotics recurred frequently and factories in leaf spot areas suffered great financial losses.

In sugar beet fields where curly top is severe, no plant escapes infection; one or two plants per 10,000 may perhaps show less severe reactions.

The significant discovery that one form of male sterility in sugar beets is inherited cytoplasmically has enabled seed to be produced that is 100 per cent. hybrid.

Wells (D. G.), Hare (W. W.), & Walker (J. C.). **Evaluation of resistance and susceptibility in garden Pea to near-wilt in the greenhouse.**—*Phytopathology*, 39, 10, pp. 771–779, 1 fig., 1 graph, 1949.

A standardized technique has been developed at the Wisconsin Agricultural Experiment Station for testing pea breeding material in the greenhouse for reaction to near wilt (*Fusarium oxysporum* f. *pisi* race 2), using the resistant Wisconsin Perfection and the susceptible Delwiche Commando varieties [*R.A.M.*, 28, p. 558]. Uniform and consistent results were obtained in 18 to 20 days by planting seedlings in clean quartz sand and inoculating 7 to 10 days later by cutting the roots about 1 in. below the seed while immersed in a spore and mycelial-fragment suspension. This is a more rapid procedure than planting peas in the greenhouse in field soil infested with the pathogen, Virgin and Walker [ibid., 19, p. 252] having shown that under the latter conditions a period of 52 days is requisite for severe disease development. The new method of testing, moreover, proved more reliable than trials for disease reaction in the field, where environmental conditions were often adverse to the complete elimination of susceptible plants.

Differences between the resistant and susceptible varieties were most clearly expressed when a sand temperature of 21° C. was maintained throughout the test period. At 24° Wisconsin Perfection contracted heavier infection, and at 27° the breakdown of resistance was even more marked. At 18° the symptoms developed so slowly that accurate differentiation between resistant and susceptible plants was impracticable after 18 to 20 days. Seed treatment with spergon before planting obviated the need for removal of the seed coats at the time of inoculation.

Yarwood (C. E.). **Effect of soil moisture and nutrient concentration on the development of Bean powdery mildew.**—*Phytopathology*, 39, 10, pp. 780–788, 1 fig., 3 graphs, 1949.

On Pinto bean [*Phaseolus vulgaris*] plants grown at Berkeley, California, in November to December, 1946, at soil moisture levels from 4 to 33 per cent. of the dry weight of the soil, powdery mildew (*Erysiphe polygoni*) developed more profusely, causing less necrosis and a heavier reduction in green weight, at low than at high moisture [*R.A.M.*, 11, p. 346; 16, p. 104]. Thus, in a typical trial, the yield reduction from powdery mildew was 82 per cent. at 8·5 to 12 per cent. moisture, 67 at 16 to 21, and 39 at 18 to 29. Comparable results were obtained with the powdery mildews of red clover, pea, and mustard (*E. polygoni* in each case), barley (*E. graminis*) [ibid., 10, p. 479], cucumber and sunflower (*E. cichoracearum*), rose (*Sphaerotheca pannosa*), and vine (*Uncinula necator*) in greenhouse tests (and with bean, barley, cucumber, sunflower, and rose in the field).

On beans grown in water culture with nutrient concentrations up to ten times as high as in Hoagland's solution, mildew development and green weight reduction increased and host necrosis decreased with rising nutrient concentrations, while plant growth reached a maximum at the standard strength. These results appear to be in agreement with those of Grainger for powdery mildew of oats [ibid., 27, p. 68].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, 60, 7, pp. 367–370, 5 figs., 1949.

The New South Wales Government regulations demand a standard of germination for all merchandized vegetable seeds, and in cases of poor germination growers are

advised to look for other causes. A table is given of protective treatments recommended by the Department of Agriculture for various vegetable seeds and potato tubers.

Scald disease of French beans [*Phaseolus vulgaris*: ibid., 24, p. 172] has been definitely recorded in one district only. The disease is thought to be associated with molybdenum deficiency, and where seed has not been produced on a soil reasonably high in molybdenum, and lime or dolomite has not been used, it is suggested that sodium or ammonium molybdate would be worthy of trial.

Ahmed (Q. A.). **Varietal resistance and susceptiblity of Phaseolus radiatus towards Cercospora.**—*Sci. & Cult.*, 14, 10, p. 436, 2 figs., 1949.

Seeds of *Phaseolus radiatus* and its vars. *grandis* and *aurea*, sown in the Dacca (Pakistan) University Botanical Garden in October, 1948, produced seedlings which in about a month developed infection by a *Cercospora*, probably *C. cruenta* [*R.A.M.*, 16, p. 660]. In the case of *P. radiatus* and its var. *grandis* (which were sown together), the leaves, flowers, pods, and even the stems were affected and ultimately the whole plot presented a scorched appearance. On the other hand, *P. radiatus* var. *aurea* showed only a few isolated leaf spots, the plants maintained their green colour, and seed production was fairly normal.

In an attempt to determine the reason for these marked differences in susceptibility, the stomatal frequency and pore size of the three varieties were examined with the following results: number of stomata on the upper leaf surface per sq. mm. in *P. radiatus* 133, var. *grandis* 138, var. *aurea* 110; on the lower leaf surface, 332, 243, and 221, respectively; and average pore size, 16·1 by 5·3, 16·1 by 2·8, and 13·6 by 2, respectively. Thus, the fewer stomata in *P. radiatus* var. *aurea* and their smaller pore size appear to confer an extra degree of protection against the pathogen.

Dale (W. T.). **Observations on a virus disease of Cowpea in Trinidad.**—*Ann. appl. Biol.*, 36, 3, pp. 327–333, 1 pl., 1949.

Further studies on cowpea mosaic in Trinidad [*R.A.M.*, 23, p. 202; 28, p. 514] showed that chlorotic lesions 2 to 4 mm. in diameter appear on the inoculated leaves of many cowpea varieties, and may consist of alternating light and dark green rings. If the leaves are inoculated before they are fully grown the local lesions tend to coalesce, and vein-clearing or mottling of all or part of the leaf may result. The next leaf to unfold generally shows conspicuous vein-clearing which, as the leaves expand, changes to a fine-grained mosaic consisting of numerous dark green islands on a pale green background. Leaves developing later have an irregular yellowish and dark green mottling with blistering of the lamina. Finally coarse, irregular mottling may be produced, but the more chlorotic coloration is usually associated with the veins, particularly at the junctions. Sometimes, particularly under greenhouse conditions, reddish-brown necrosis of the veins is present, though not usually extensively [cf. ibid., 26, p. 524].

Young *Phaseolus mungo* and *P. aureus* plants react by the production of chlorotic local lesions, followed by striking yellow vein-clearing of the first young leaf to unfold after infection. Severe green and yellowish mottling of leaves developing later may be accompanied by blistering of the lamina. Infected soybeans are stunted, owing to shortening of the internodes and petioles, the leaves are dark green and crinkled and have downturned edges. Axillary shoots proliferate; small leaves may show light and dark green mottling, the latter more pronounced in the greenhouse. Infected plants either fail to seed or produce few pods.

Infected sunn hemp (*Crotalaria juncea*) plants develop leaf distortion and various types of mottling, accompanied by stunting; the leaf symptoms include variable mosaic patterns and chlorotic ring spotting, while localized necrosis may occur on

leaves developing shortly after infection. On pigeon pea, chlorotic local lesions precede yellowish vein-clearing, which is followed by foliar mottling or general chlorosis; artificial infection of young seedlings often results in necrosis and death of the apical bud.

Vigna vexillata, *Desmodium frutescens*, *P. trinervius*, *Psophocarpus tetragonobolus*, and *Sesbania speciosa* are susceptible to systemic infection. When the simple leaves of *Canavalia ensiformis* [cf. ibid., 26, p. 479] are inoculated chocolate brown, necrotic local lesions, mostly about 1 mm. across and having a faint yellow halo, are produced. *Dolichos lablab* reacts similarly, but the few local lesions produced do not become necrotic.

Systemic symptoms, when produced, appear within 14 days of inoculation, this period being shorter for rapidly growing plants, while in cowpea and sunn hemp it may be three days. Local lesions appear in two to four days. Young plants of systemically invaded species are more severely affected than old ones, and initial leaf symptoms are usually more severe than later ones.

The thermal inactivation point of the virus was 66° C., the dilution end point 1 in 100,000, and longevity *in vitro* over 20 days. The virus is seed-borne in asparagus bean (*V. unguiculata*), but apparently not in the tested cowpea varieties. Tests showed that *Ceratoma ruficornis* was an efficient vector in Trinidad, giving 30 per cent. transmission with one beetle per plant. It retains the virus for six days. The virus does not appear to be a strain of cucumber mosaic, and may possibly be the same as that recorded by Smith in 1924 [ibid., 4, p. 203].

Insect control by dusting is uneconomic. The planting of susceptible legumes in close proximity or succession should be avoided.

Hervey (G. E. R.) & Schroeder (W. T.). **The yellows disease of Carrot.**—*Bull. N.Y. St. agric. Sta.* 737, 29 pp., 8 figs., 14 graphs, 1949.

The carrot yellows disease (aster yellows virus) was studied from 1945 to 1948 in western New York State. In 1947 and 1948, respectively, there was 35 and 25 per cent. average infection in fields. In 1946 some fields showed as much as 85 per cent. diseased carrots. Experiments on control of the leafhopper (*Macrosteles divisus*) which transmits the disease [*R.A.M.*, 27, p. 107] showed that spraying at 10-day intervals with DDT containing 0·5 per cent. petroleum oil, three times during late July and in August, the peak of leafhopper abundance, gave 75 to 80 per cent. reduction of the disease. Spraying was superior to dusting. Morse's Bunching and Nanchan were the varieties least affected by yellows in field trials. The differences in response of various strains and varieties in the field is attributed more to leafhopper preference than to inherent physiological resistance.

Prasada (R.) & Verma (U. N.). **Studies on Lentil rust, Uromyces fabae (Pers.) de Bary, in India.**—*Indian Phytopathology*, 1, 2, pp. 142–146, 1948 [? 1949].

Rust (*Uromyces fabae*) [*R.A.M.*, 27, p. 114; 28, pp. 161, 350; 29, p. 5] of lentils occurs regularly in Delhi during February when pycnia and aecidia are present. Secondary aecidia develop profusely and infection is disseminated through aecidiospores. Uredosori appear late in the season, rapidly followed by teleutosori.

Secondary aecidia formed at 17° to 22° C. and uredosori at 25°. The teleutospores required no rest period and germinated at 12° to 22°; they remained viable throughout summer in the open and indoors, viability at 3° to 18° persisting for two years. Aecidia were obtained by inoculating lentil plants with germinating teleutospores in January and February. In the inoculation experiments aecidiospores produced aecidia in successive generations when the temperature was under 20° to 22°, whereas at 25° uredosori formed. The aecidiospores germinated between 7° and 22°, and remained viable for two months at 3° to 8°. Uredospores germinated

between 7° and 22°, 17° to 18° being the optimum; in storage, they remained viable for 16 weeks at 3° to 8°.

At Delhi, the aecidio- and uredospores die following harvest, but the teleutospores resist the heat, germinate in January if the weather is favourable, and cause fresh outbreaks. Plants from seed sown with pieces of infected host tissue all developed aecidia, whereas those from seed treated with agrosan were healthy. It is suggested that all plant debris should be burnt.

Ramakrishnan (K.) & Ramakrishnan (T. S.). **Banded leaf blight of Arrowroot, Maranta arundinacea.**—*Indian Phytopathology*, 1, 2, pp. 129–136, 2 pl., 1 fig., 1948 [? 1949].

In July, 1946, during the south-west monsoon, arrowroot plants (*Maranta arundinacea*) growing at Ancharakandy, North Malabar, became widely affected by a banded leaf blight. The disease, a chlorotic banding of the leaves with ultimate browning and rotting, spread rapidly in close association with heavy rain. The same disease was also noted in the same locality during July to October, 1947 and 1948.

Infection began on young and old leaves as small, water-soaked spots which, under favourable conditions, rapidly enlarged. Meantime, slender aerial hyphae extended quickly over both leaf surfaces. Sometimes the spot spread in a succession of zones. Transverse, necrotic, light green to yellowish-brown patches, separated by healthy green or pale green areas were present, forming irregular bands extending across the whole, or half the blade. Some of these bands were whitish. Meanwhile, hyphae had grown over the whole leaf with cobwebby extensions to neighbouring blades. Infection did not much affect the sheath or shoot. In the rainy season the infected leaves finally turned brown and in some cases became involved in a wet rot greatly accelerated by saprophytes. As a result of the severe blighting produced rhizome formation was adversely affected. Examination of the pathogen showed it to be *Corticium solani*.

Inoculation experiments with pure cultures gave positive results on a wide range of hosts grown in pots, and uniformly on young and old arrowroot leaves.

Satisfactory control was obtained in four gardens by preventive spraying with 1 per cent. Bordeaux mixture in July. Spraying should be carried out every year before the monsoon, using special care to obtain complete coverage of both leaf surfaces.

Meuli (L. J.) & Swezey (A. W.). **Soil fumigation for the control of Sweet Potato black rot.**—*Down to Earth*, 5, 3, pp. 2–4, 4 figs., 1949.

Control of black rot of sweet potato (*Ceratostomella fimbriata*) [*R.A.M.*, 28, p. 641], as well as of nematodes and wireworm, was obtained in California in 1945 by treating field plots with ethylene dibromide. Applications at the rate of 2, 4, and 6 gals. per acre, resulted in no black rot developing compared with 33 per cent. in untreated sections. In 1946 ethylene dibromide was more effective against black rot and wireworm at the low dosage than against the nematode. The average black rot damage for the untreated plots was 11·3 per cent. and for treated 1·8. Commercial applications are usually at the rate of 3 gals. per acre, but seed beds are treated with 4 gals. per acre. It is pointed out that the use of ethylene dibromide in controlling certain soil pests may also lead to the control of parasitic fungi, particularly wound parasites, involved in the soil complex [cf. ibid., 28, p. 15].

Bulloch (Mc G.). **A new Mushroom disease.**—*Bull. Mushroom Grs' Ass.* 18, p. 24, 1 fig., 1950.

A hitherto unrecorded disease was observed on cultivated mushrooms (*Psalliota* spp.) in Kent during the summer of 1948 and on several occasions since in Dorset. Infection spreads with great rapidity in humid conditions, the fungus producing

dark chocolate-brown patches of various sizes with a thin, close layer of mycelium. On weak, spongy tissue, colonies form white, hemispherical, close tufts with profuse conidial growth, the affected patches being of a pale tan colour before the onset of the disease. The cap of the mushroom is frequently covered with uniformly spaced tufts of a similar size. The causal organism was provisionally identified as a species of *Acremonium*. Good control was effected by spraying the beds with a 0·1 per cent. sodium hypochlorite solution (10 per cent. w/v available chlorine).

Edwards (R. L.). **Science in the Mushroom industry.**—*J. Minist. Agric.*, 56, 9, pp. 434–442, 1949.

This review of literature, dealing with the scientific cultivation of mushrooms [*Psalliota* spp.], comprises sections on mushroom nutrition, synthetic composts [see next abstracts], diseases and competitors (pp. 437–438), pests, and progress in cultivation.

Edwards (R. L.). **Developing a synthetic compost.**—*Bull. Mushroom Grs' Ass.* 15, pp. 84–88; 17, pp. 187–190, 1949.

Experiments at the Mushroom Research Station, Yaxley [*R.A.M.*, 28, p. 374], demonstrated that 3 cwt. dried blood (12 per cent. nitrogen) in a compost made up of 14 lb. superphosphate, 35 lb. gypsum, 14 lb. potassium sulphate, and 50 lb. calcium carbonate in a ton of unwetted wheat straw, was a better source of nitrogen for mushroom [*Psalliota* spp.] cultivation than nitrochalk or a mixture of nitrochalk and ammonium sulphate. In mixtures of dried blood and nitrochalk to make the total added nitrogen, 75 per cent. of the former is better than 25 per cent.

Report Mushroom Research Station, Yaxley, for the years 1946–1948.—71 pp., 3 figs., 1 diag., 9 graphs, Mushroom Research Association Ltd., Yaxley, Peterborough, 1949. 10*s*.

In this report on mushroom research [see preceding and next abstracts] R. L. Edwards gives a full account of cropping experiments and concludes that gypsum has an early beneficial effect on spawn run and cropping and although it does not give a greater total yield in 20 weeks' growth, it cannot be replaced by ground limestone to promote spawn growth in the compost used. Heavier mushrooms and a bigger crop per sq. ft. were obtained by increasing the depths of the beds by 50 per cent., but shallow beds gave a heavier crop per ton of manure. A bigger crop in the first few weeks was obtained from beds spawned at 8 in. intervals than at 12 in., but the latter drew level after 14 to 16 weeks. Raising the nitrogen (supplied as dried blood) [see preceding abstract] increased the size and total crop and lengthened the cropping period, while raising the phosphate had the reverse effects. The addition of some superphosphate at the end of composting caused earlier cropping and increased numbers and total yield. With dried blood as the source of nitrogen the potassium requirement (supplied as potassium sulphate) was low while with nitrochalk it was high. The mixture of salts recommended by Stoller [*R.A.M.*, 23, p. 87] produced the earlier, largest, and longest maintained crop in comparison with dried blood, inorganic nitrogen, and Treschow's mixture [loc. cit.]. Castor bean meal raised the yield of both the dried blood and nitrochalk composts; sugar beet tailings raised the yield of the high nitrochalk compost to that of high dried blood. When trays were filled with compost at successive turns and then spawned, fruiting started soonest on fifth turn compost and last on fourth turn. Beef extract brought composts into cropping 10 to 20 days earliest and increased the number and weight of mushrooms produced on compost taken at the third, fourth, and fifth turns, the greatest increase being with fourth-turn compost.

In the chemistry section of the report S. Burrows gives the results of analyses to show the changes in pH, dry matter, and nitrogen during composting, and in dry

matter and oxalate during cropping. It was found that there is no correlation between water losses and yields, but a highly significant correlation existed between water losses and original water contents. The rate of denitrification during composting and cropping is dependent on the percentage nitrogen present.

C. J. La Touche gives lists of the actively growing fungi, as determined by the slide trap technique [ibid., 28, p. 134] and other methods, in horse manure, synthetic compost based on straw with dried blood, and wet straw [all] incubated at 45° C., and of fungi identified on mushrooms or mushroom beds or in soil intended for casing, during the period under review.

Edwards (R. L.). **Developing a synthetic compost. 2. Nitrogen and phosphorus requirements.**—*Bull. Mushroom Grs' Ass.* 18, pp. 39–40, 1950.

In this summary of experiments on mushroom composts, most of which has already been noticed [see preceding abstracts], it is concluded that the addition of 35 lb. superphosphate per ton of straw at stacking and 70 lb. at filling is better in every way than adding 105 lb. at stacking.

Atkins (F. C.). **Major diseases and competitors of the cultivated White Mushroom.** —23 pp., 28 figs., Mushroom Growers' Association, Yaxley, Peterborough, 1949. 5*s.* net.

This revised paper includes brief notes on the following additional diseases of cultivated white mushroom [*Psalliota* sp.: *R.A.M.*, 27, p. 592]: damping-off or wilt (*Fusarium* [*solani* var.] *martii*, *F. oxysporum*, *F. culmorum*, *F. flocciferum*, and several other species) [ibid., 19, p. 5], mummy disease (of unknown etiology) [ibid., 27, p. 273], mat disease and verdigris (*Myceliophthora sulphurea* and *M. lutea*, respectively) [ibid., 28, p. 268], brown plaster mould (*Papulaspora byssina*) [ibid., 26, p. 4], and others previously published separately [ibid., 26, p. 281; 27, p. 216].

Esselen (W. B.) & Fellers (C. R.). **Mushrooms for food and flavor.**—*Bull. Mass. agric. Exp. Sta.* 434, 11 pp., 12 pl., 1946. [Received July, 1949].

This bulletin summarizes the results of laboratory studies carried out in the Food Technology Department of the Massachusetts Experiment Station on the food value of cultivated mushrooms (*Agaricus* [*Psalliota*] *campestris*) [*R.A.M.*, 25, p. 334]. They contain iron (19·5 p.p.m.) and copper (1·35 p.p.m.), and are excellent sources of several vitamins of the B complex, containing 5·85 (mg. per 100 g. fresh weight) nicotinic acid, 0·52 riboflavin, 2·38 pantothenic acid, 0·12 thiamine, and biotin [ibid., 24, p. 405].

Parmentier (G.). **Le rougeau de la Vigne.** [Rougeau of the Vine.]—*Bull. Inst. agron. Gembloux*, 16, 1–4, pp. 43–107, 6 figs., 3 graphs, 1947. [Flemish, German, and English summaries. Received July, 1949.]

Distinguishing (largely from a review of the relevant literature) between the different forms of reddening (or rougeau) of vine leaves due to the formation of anthocyanin [*R.A.M.*, 12, p. 675], the author states that only the forms caused by insect attack, possible virus agency [ibid., 13, p. 492], and physiological disturbances [ibid., 5, p. 467] occur in Belgium. The generalized leaf-reddening found in Belgium is of physiological origin and would appear to be due solely to excess hydration of the leaves caused by a reduction in osmotic pressure resulting from potassium deficiency and counterbalanced by an increase in heterocyclic materials, this being the first step to anthocyanin formation.

Of the various causes of physiological rougeau cited in the literature disturbances in the water relations of the host appear to be one of the most important. A bibliography of 89 titles is appended.

Bernon (G.). **Le mildiou dans le midi de la France en 1948.** [Mildew in the south of France during 1948.]—*Progr. agric. vitic.*, 132, 38–39, pp. 181–189, 1 fig., 6 graphs; 40–41, pp. 209–215; 42, pp. 231–237, 1 diag., 2 graphs, 1949.

During 1948 [downy] mildew [*Plasmopara viticola*: cf. *R.A.M.*, 26, p. 228; 28, p. 437] caused serious damage to vines in the south of France, particularly in the department of Gard, where the losses amounted to more than 300.000 hl., calculated from the difference between the 1947 and 1948 harvests. Primary lesions appeared early in 1948, about 17th April. They were found usually on small lower leaves, sometimes deformed by frost, where they frequently passed undetected. Secondary spread was greatly enhanced by heavy rains on 24th and 25th May. The number of mildew spores released is proportionate to the frequence, duration, and violence of the showers. In the Beaucaire plain two particularly devastating invasions took place on the 2nd and 19th of June coincident with long and violent rains, the second being the cause of the harvest losses. Vines situated on an open hillside and having scanty foliage are generally more resistant to mildew attacks than those growing in the humid plains and producing abundant, lush new growth, although the former may be attacked when the control measures are inadequate.

From experiments and observations made during 1948 it is concluded that control measures applied at the first appearance of mildew delay the period of dangerous activity. When these measures fail vigorous control should be started earlier than usual, the strength of the copper mixture increased from 2 to 3 per cent., the treatments applied more frequently, and to the inflorescences first, followed by the bunches. Since it is impossible to forecast rainfalls with certainty during the preceding 48 hours, it is best to conduct the treatments more intensively than usual so that the foliage is never insufficiently protected, and in accordance with growth rate of the branches, and spaced according to conditions prevailing in the vineyard concerned. The author describes a method of measuring the growth rate, the construction of simple growth curves, and the method of determining from the curve the required frequency of the treatments.

Kaşkaloğlu (N.). **The importance of early treatment against powdery mildew.**—*Mahsul Hekimi* (*Plant Prot. J.*), 2, 12, pp. 262–264, 1949. [Turkish, with English summary.]

In a series of spraying experiments to determine the relative efficacy of early and late treatments in the control of vine mildew (*Uncinula necator*) in Turkey, the former proved superior. The index figures (0 representing freedom from infection) were as follows: thiovit (0·75 per cent.) early and late, 1·46 and 1·67, respectively, control, 2·74; spersul (0·66 per cent.) early and late, 1 and 1·2, respectively, control, 2·54.

Holmes (F. O.). **The filterable viruses.**—Bergey's manual of determinative bacteriology. Sixth edition. Supplement 2, xiii+160 pp., London, Baillière, Tindall & Cox, 1948. 20*s*. [Received October, 1949.]

The second supplement to Bergey's manual [*R.A.M.*, 28, p. 514] has been published as a separate volume.

Limasset (P.). **La systématique des virus phytopathogènes.** [The systematics of phytopathogenic viruses]—*Ann. Épiphyt.*, N.S., 14 (*Sér. Path. vég. Mém.* 6), pp. 283–295, 1948. [Received November, 1949.]

The author adduces reasons in support of his view that, for the present at least, the most satisfactory solution of the problem of virus nomenclature is to adopt the classification of Holmes with McKinney's modifications [*R.A.M.*, 27, p. 400; 28, p. 412, and preceding abstract]. He discusses the concepts of species, genera,

families, and higher groups in relation to viruses and points out that certain imperfectly known viruses cannot legitimately be placed in any broad natural group. This applies, in particular, to those viruses which are transmissible (so far as is known) only by grafting. These might, he suggests, be placed provisionally in an 'artificial' family, the Invectoriae, within which the different genera would be distinguished by the symptoms they produce. While symptoms are not a valid criterion for distinguishing species, it is permissible to use them for distinguishing families and genera, provided it is admitted that they only indicate tendencies. The mode of transmission is a more important distinguishing factor than symptoms; viruses transmitted by leafhoppers should be separated from those transmitted by aphids. The author criticizes Holmes's classification and suggests various modifications. Some viruses are certainly not living entities, and it is probable that among those transmissible (at present) only by grafting, some are of the same nature as plasmagenes.

Smith (K. M.). **Viruses and virus diseases.**—*J. R. hort. Soc.*, 74, 11, pp. 482–491; 12, pp. 521–528, 19 figs., [8 pl.], 1949.

This paper given as a Masters Memorial Lecture, 1949, deals with all the various aspects of viruses and virus diseases. In discussing virus strains and immunity the author states that acquired immunity is of use in finding out virus relationships. The recently found virus which causes leaf mottling, serious flower malformation, and stunting of *Chrysanthemum* plants could not be made to infect cucumber. A series of plants of *Nicotiana glutinosa* was infected with the *Chrysanthemum* virus, resulting in curious malformation of the leaves, and another series with yellow cucumber mosaic virus. In no case was it possible to bring about a cross infection of the two series. It seems, therefore, that the virus from the *Chrysanthemum* is related in some way to the cucumber mosaic virus. In the last ten years the green-mottle mosaic of cucumber seems almost to have disappeared [from Great Britain] and its place has been taken by yellow-mottle mosaic [? strain of cucumber mosaic virus: *R.A.M.*, 28, p. 270]. As well as the undescribed virus disease of *Chrysanthemum*, which is transmitted by aphids and can infect tomato and other plants, tomato spotted wilt virus [ibid., 27, p. 136] is important in this host because the plant grows away from the symptoms but remains as an unsuspected source of infection for many other species. It is probable that symptomless carriers of viruses are more common than has been thought. For example, the Dahlia varieties Bishop of Llandaff and Leland Stanford carry cucumber mosaic virus and tomato spotted wilt virus [ibid., 28, pp. 210, 588], respectively.

The best known viruses carried in the seed are those causing mosaic in French beans (*Phaseolus vulgaris*) and in lettuce [ibid., 28, p. 324]. There are two known cases of virus inheritance by the progeny of a virus-carrying insect, (1) the dwarf disease of rice [ibid., 28, p. 588] and (2) the clover club leaf disease [ibid., 27, p. 239]. In the latter case the virus has been carried for a period of four years covering fifteen generations. If the virus is considered not to have multiplied then there must have been a dilution of 10^{-17}, which is far beyond the dilution point for infectivity.

In the author's garden in 1948 three or four broad bean plants developed unfamiliar symptoms suggestive of a virus infection. Inoculations also gave unfamiliar symptoms on test plants, and later nasturtium (*Tropaeolum*) plants far removed from the beans were found to be infected with the same virus. They developed mottling, distortion of the leaves, necrosis in patches, stunting, and falling off in flower production. The virus was of the ring spot type with a wide host range, including cucumbers, tomatoes, and *Petunia*. On the latter under certain circumstances a large number of rings are produced on the flower petals. The vectors are one or more species of aphids, including *Myzus persicae*.

Harris (R. V.). **Plant pathology.**—*Rep. E. Malling Res. Sta., 1948*, pp. 39–41, 1949.

In this report [cf. *R.A.M.*, 28, p. 323] it is stated that further work at East Malling Research Station on bacterial diseases of stone fruits [*Pseudomonas morsprunorum* and *P. prunicola*: ibid., 26, p. 159; 27, p. 76] has shown that seasonal and varietal variations of the cell sap buffer complex and sap sugar concentration markedly affect the *in vitro* growth of the pathogenic bacteria [cf. ibid., 28, p. 406]. Field work on the seasonal cycle of these diseases during a period of three years suggests that a re-timing of the spray schedule is desirable. The seasonal cycle in Britain closely agrees with that in America, particularly as regards the time when the bacterial population of wounds and the rate of canker extension are at a maximum. Numerous stem cankers developed on the sweet cherry trees on which different bactericides are being compared [ibid., 28, p. 336]; all the sprays (applied in autumn and at pre-blossom) gave some control though, the 1948 season being wet, none was outstanding.

Strawberry black root rot [ibid., 14, p. 179; 28, p. 580] caused considerable loss in a southern area and seems to be increasing generally; no specific organism could be isolated. Ten new samples of strawberry plants were graft-tested for viruses and six (five of them virus-free) were selected for propagation and further study. Two further clones (M. 45 Perle de Prague and M. 46 Auchincruive Climax) derived from plants tested in previous years have been released and approved for the Strawberry Special Stocks Certification Scheme [ibid., 28, p. 341].

Graft testing of M. 40 Royal Sovereign plants in the Special Stock nurseries indicated that many were infected with virus, though the symptoms would probably be imperceptible in the field; in most cases virus 4 appeared to be present, but a few plants showed viruses 1, 2, and 3. Similar testing of 100 M. 44 Huxley from a Special Stock nursery indicated that 25 per cent. had become infected with other viruses, though as this clone is infected with mild crinkle, identification is difficult. In some the infection could be classified as 'breakdown', but in most it had no appreciable effect on vigour. These tests confirm the view that Special Stock clones are gradually becoming infected under field conditions, and show that this reinfection has gone farther than had been suspected.

Williams (P. H.), Howles (R.), Grossbard (Erna), Messing (J. H. L.), & Owen (O.). **Plant diseases. Chemical problems.**—*Rep. exp. Res. Sta. Cheshunt, 1948*, pp. 13, 20–21, 24–42, 73–81, 2 figs., 1949.

In this report [cf. *R.A.M.*, 27, p. 111] it is recorded that blotchy ripening [ibid., 24, p. 91] of Ragworth Beauty and Melville Castle tomatoes was negligible where the plants were grown in cardboard boxes, was greater where the soil was very heavily flooded in the winter, and still greater where the plants were sprayed with a minor elements solution. Cardboard boxes treated with cuprinol showed no signs of decay at the end of the season, while those not treated were badly rotted.

The average yield of mushrooms [*Psalliota* spp.: see above, p. 195] in four months when grown on horse manure was 1·9 lb. per sq. ft. compared with only 1·2 lb. on the best of the synthetic composts. Any weight less than 1·5 lb. is a poor crop and any attempt to steam sterilize the old beds for a second crop, even after the addition of a proportion of fresh manure, appears to be useless.

P. H. Williams reports that in experiments on the influence of manurial treatment on the infection of Potentate tomato plants by *Didymella lycopersici* there were no definite indications that the amount of infection was conditioned by the amount of nitrogen, potassium, or phosphate in the soil. Evidence was obtained that the fungus probably survives longer at low temperatures and in comparatively dry soil. When isolating *Didymella* from soil it was found that rose bengal added

to Dox agar at various dilutions reduced contaminants and also the number of *D. lycopersici* colonies, but at 0·008 per cent. the bacteria persisting usually form only small, punctiform colonies. There appeared to be some thermostable substance favouring the production of *D. lycopersici* pycnidia in juice extracted from tomato stems and leaves. They formed after four weeks when crude or autoclaved extract was added to various media. Pycnidia were produced on tomato stems and wheat straw sterilized by propylene oxide [ibid., 26, p. 461].

R. Howles reports that a fresh 1 per cent. tannic acid spray on tomato plants appears to be an efficient protectant for preventing the mechanical spread of tomato aucuba mosaic virus infection [strain of tobacco mosaic virus: ibid., 28, p. 252]. Solutions of 0·1 per cent. urea and 0·1 per cent. potassium bicarbonate are less suitable.

Heat treatment [cf. ibid., 21, p. 340] of *Solanum capsicastrum* plants for 60 hours in a dark oven at 105° F. after inoculation with a weak solution of tobacco mosaic virus resulted in fewer plants showing infection than in unheated plants. They also recovered more quickly from the disease.

Erna Grossbard, in further work on the effect of an antibiotic substance produced by *Penicillium patulum* in controlling damping-off in tomato seedlings by *Phytophthora parasitica*, reports that only 1 per cent. damping-off occurred where 2·5 per cent. molassed sugar beet pulp was incorporated with soil inoculated with both *P. parasitica* (locally) and *Penicillium patulum* compared with 11 per cent. where *P. patulum* was not used. When the pathogen was mixed evenly through the soil instead of being applied locally the corresponding percentages of damping-off were 19 and 63. Timothy grass [*Phleum pratense*] was found to be a suitable substratum for antibiotic production by *Penicillium patulum* in the soil. Red clover caused a loss in antibiotic activity. All fertilizers also reduced it, superphosphate causing least suppression.

In experiments on the effect of some acute mineral deficiencies on glasshouse plants, J. H. L. Messing and O. Owen found that *Asparagus plumosus* [var.] *nanus* and *S. capsicastrum* are very susceptible to deficiencies of calcium, boron, and magnesium, even when the plants have been raised and grown for some time in a complete nutrient. If calcium or boron is omitted the new shoots of *A. plumosus* [var.] *nanus* die, in the former case completely and in the latter only the top inch. Experiments with three varieties of indoor chrysanthemums disclosed the existence of varietal susceptibility to deficiencies. In tomatoes the effects of deficiency seem to be related to the time from which it operates, for example, calcium deficiency is evident earlier and is more pronounced than magnesium when plants have been first established on a complete nutrient, but later if seedlings are grown from the start in a deficient solution.

O. Owen describes a leaf colour disorder of *S. capsicastrum* due to magnesium deficiency which can be corrected by the addition of an amount of Epsom salts [magnesium sulphate] equal to the potassium sulphate [cf. ibid., 25, p. 291] used as fertilizer, or where a mixed fertilizer is applied, twice the amount of potassium (as potassium oxide) present.

Zogg (H.), Horber (E.), & Salzmann (R.). **Pflanzenschutz.** *Ex* **Bericht über die Tätigkeit der Eidg. landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon pro 1947/48.** [Plant protection. *Ex* Report on the work of the Federal Agricultural Experiment Station Zürich-Oerlikon for 1947–8.]—*Annu. agric. Suisse*, 50, 4, pp. 383–395, 2 figs., 1949.

As in the previous year [*R.A.M.*, 28, p. 113], foot rots (including *Ophiobolus graminis*, *Cercosporella herpotrichoides*, *Fusarium* spp., and *Helminthosporium gramineum*) caused heavy losses among cereal crops. *F. nivale* [*Calonectria nivalis*] was less prominent in the form of an actual snow mould than as a pathogen of young

rye seed, inducing typical corkscrew-like growth of the seedlings and later attacking the ears.

A devastating outbreak of potato blight (*Phytophthora infestans*) [ibid., 29, p. 49] marked the summer of 1948. Control measures were hindered by the changeable weather, and the spray deposits were repeatedly washed off by recurrent showers. Both the foliage and tubers of the most widely cultivated Bintje variety were severely damaged, while half the Arran Banner crop was in many cases lost through tuber infection. *Spongospora subterranea* was observed locally, especially on the heights, evidently as a consequence of the damp, cool weather. Special attention was paid to the control of potato wart (*Synchytrium endobioticum*) following its recrudescence in 1947, when a further 33 new foci were reported in the Prätigau besides those already enumerated in the mountain valley of Einsiedeln. In 1948 the total number of new centres of infection was 23. The measures so far adopted for the extirpation of the fungus are turning the infested areas into grassland, prohibiting the export of potatoes from the two valleys in question, and the cultivation of immune varieties.

Heart rot [boron deficiency] occurred in beets [ibid., 15, p. 696] in various localities, sometimes in a severe form. Other diseases of the crop were crown gall [*Bacterium tumefaciens*] and leaf spots caused by *Ramularia betae*, *Alternaria tenuis*, and *Phoma betae*.

Fusarium lini was the principal pathogen of flax, which is grown only on a relatively small scale.

Benlloch (M.). **Observaciones fitopatológicas en el año 1948.** [Phytopathological observations in the year 1948.]—*Bol. Pat. veg. Ent. agríc., Madr.*, 16, pp. 203–242, 25 figs., 1949.

A defective union between stock and scion was found to be the cause of typical court-noué symptoms in young vines in Spain.

Specimens of medlars intensively attacked by *Fusicladium dendriticum* var. *eriobotryae* [*Venturia eriobotryae*: *R.A.M.*, 28, p. 460] were received from the provinces of Granada, Malaga, Cadiz, and Huelva, where heavy damage was caused under the favourable conditions induced by the frequent spring rains. The control measures recommended were the excision and burning of the most severely infected twigs and spoilt fruits and spraying with 2 per cent. Bordeaux mixture during the dormant period and 1 per cent. for subsequent treatments.

Wheat in Andalusia and Estremadura sustained exceptionally heavy damage from *Puccinia glumarum* [ibid., 28, p. 322], resulting locally in yield reductions of 50 to 100 per cent. Not only were the susceptible summer and soft varieties attacked, but even the hard and normally resistant, like Senatore Capelli.

Early potato crops, especially in Andalusia and Murcia, were heavily infected by blight (*Phytophthora infestans*) [ibid., 25, p. 228], which also rotted tubers sent to the Madrid market.

For the first time since its detection in Spain in 1944, angular leaf spot [*Isariopsis griseola*: ibid., 25, p. 97] of bean [*Phaseolus vulgaris*] was observed by the author in Granada and Barcelona and also reported from Valencia and Teruel. *Sclerotinia sclerotiorum*, rare in the country and not hitherto recorded from the south, caused severe local damage to beans in Granada. During the last few years the bacterial blights of bean (*Bacterium* [*Pseudomonas*] *medicaginis* var. *phaseolicola* and *Bact.* [*Xanthomonas*] *phaseoli*) have been the object of a special investigation, still in progress, to search for disease-free areas which could be utilized for seed production.

Chick pea [*Cicer arietinum*] plantings were largely destroyed, especially in Andalusia, by *Fusarium* and *Phyllosticta* [*Ascochyta*] *rabiei* [ibid., 21, p. 403].

The symptoms of a new disease responsible for heavy damage to the tomato crops of Teneriffe, Canary Islands, agree with those produced in the United States

by tomato mixed-virus [streak] (tobacco mosaic plus potato latent mosaic [potato virus X]).

Virulent infection of beets by crown gall (*Bacterium tumefaciens*) was reported from Cordova.

Annual Report of the Department of Agriculture and Stock for the year 1948–49, Queensland.—99 pp., 6 pl., 7 graphs, 2 maps, 1949.

In the section of this report [cf. *R.A.M.*, 28, p. 196] dealing with the work of the Horticulture Branch (pp. 27–32) S. A. Trout states that owing to very humid conditions during the preceding summer pineapple water blister [*Ceratostomella paradoxa*: ibid., 27, pp. 208, 221, 375] caused considerable losses in consignments sent to canneries and distant markets. Black heart [ibid., 21, p. 183] causes an over-all loss of about 5 per cent. in the winter crop. In 1948, maximum incidence developed eight to 14 days after a period of low maximum temperatures; it was also induced by allowing severed fruits to ripen in the field. Further work is in progress.

Much wastage from superficial scald [ibid., 26, p. 229; 28, pp. 377, 578, 630] occurred in Granny Smith apples stored in the Stanthorpe district, owing to the oil content of the wraps being low. Very good control was obtained by dipping the fruit in an alcoholic solution of oil, which also retarded ripening and caused slight calyx injury.

In the report of the Bureau of Sugar Experiment Stations (pp. 32–38) N. J. King states that losses in the ratoons at Mackay due to stunting disease [ibid., 29, p. 173] are estimated at 100,000 tons of cane. Fiji disease [ibid., 28, p. 243] in Bundaberg was kept within reasonable limits by the control measures adopted, despite the fact that the 1944–5 peak represented a 25 per cent. increase on the previous year. Thereafter, the decline in Fiji disease closely followed that in P.O.J. 2878. In the Moreton area the gradual elimination of P.O.J. 2878 is reducing the number of affected stools.

Chlorotic streak disease [loc. cit.] yield trials again showed that P.O.J. 2878 suffers severe losses and indicated that Q.47 and Q.49 may also give reduced yields when attacked.

In the report of the Science Branch (pp. 41–46), J. H. Simmonds states that sorghum smut (*Sphacelotheca sorghi*) [ibid., 27, p. 18] has continued to appear where seed treatment has been neglected. The organic mercury dusts marketed in Queensland contain 1·5 per cent. mercury compound; 2 oz. per bushel of seed is required for heavy infections. Dwarf *Setaria* (*Panicum*) crops showed moderately severe infection by *Piricularia oryzae* [cf. ibid., 27, p. 581]; when wet weather coincides with crop maturity there is no means of control. Early in the season groundnuts were badly affected by crown rot (*Aspergillus* sp.) [ibid., 27, p. 9]. High incidence was related to wet weather during harvesting of the previous crop; this led to the development of moulds in the stooks, with resultant low germinability of the seed. There were many instances of non-parasitic browning in flax crops [ibid., 25, p. 540] following unusually wet conditions early in winter.

Citrus psorosis [ibid., 13, p. 300; 28, p. 511] caused considerable concern, particularly as regards finding budwood free from the trouble. An extensive survey is being made to determine distribution and varietal susceptibility.

A short, wet picking season resulted in an exceptionally high incidence of pineapple water blister. Growers who followed Departmental recommendations regarding sanitation and careful handling suffered comparatively small losses, but the reverse was the case when these precautions were not taken. Removal of basal knobs before transport was an important cause of loss, exposing as it does an ideal site for the entry of *C. paradoxa*. Papaw die-back [ibid., 23, p. 448], very severe in 1948, caused little damage in 1949: efforts are being continued to determine the cause of the disease. Powdery mildew (*Sphaerotheca* sp.) [loc. cit.] of papaws caused

considerable loss in some instances; most growers are regularly using sulphur dusts against this disease. Copper oxychloride was again the only material to give good control of cucumber downy mildew [*Pseudoperonospora cubensis*: ibid., 23, p. 161; 27, p. 506] with no great injury to the plant.

Lucerne violet root rot (*Helicobasidium purpureum*) [ibid., 20, p. 151] was recorded again. Leaf mould (*Cladosporium fulvum*) [cf. ibid., 28, p. 270] was prevalent in a field crop of tomatoes at Charters Towers where the plants were closely spaced and furrow-irrigated. *Sclerotium rolfsii* [cf. ibid., 18, p. 80; 19, p. 544; 27, p. 47] caused about 20 per cent. loss from crown rot in a two-year-old planting of apple trees. Spotted wilt virus caused widespread infection of *Bidens pilosa*, and crown gall [*Bacterium tumefaciens*] was recorded from *Croton* and *Dahlia* [cf. ibid., 25, p. 545; 28, p. 159].

PERALTA (G. J.). **Appendix 6. Report by the Plant Pathologist for the year 1946–7.** —*Rep. Dep. Agric. Malta, October 1938 to September 1946 and the agricultural year 1946–7*, pp. lxxiv–lxxix, 1949.

In this report [cf. *R.A.M.*, 17, p. 589] it is stated that during 1946–7 a peculiar form of citrus die-back appeared in the Attard–Lia–Balzan triangle, Malta, causing great damage. More prevalent, apparently, on tangerines than on other kinds of citrus, the disease was characterized by its rapid onset, a complete absence of root symptoms in most cases, and rapid death. *Colletotrichum gloeosporioides* [cf. ibid., 27, p. 319; 28, p. 378] was isolated from affected twigs. It is probable that an abnormal concentration of salts in the soil resulting from persistent drought lowered the resistance of the trees and allowed the organism to become parasitic. Further investigations are in progress. Citrus trees also suffered considerably from sooty mould (*Limacinia penzigii*) [ibid., 28, p. 8].

Potato black leg (*Bacillus phytophthorus*) [*Erwinia phytophthora*: ibid., 28, p. 478] appeared in some districts on the summer crop, and leaf roll also developed, though spread was limited. In both cases affected plants were removed and destroyed and the soil sterilized. Sulphur dusts against *Erysiphe communis* [*E. polygoni*: ibid., 26, p. 317] on peas, *E. cichoracearum* on cucumbers [ibid., 28, p. 373], and *E. polygoni* on tomatoes [ibid., 24, p. 271], particularly on the late crop, were applied on an unprecedented scale and everywhere gave satisfactory results.

Vine powdery mildew (*Oidium tuckeri*) [*Uncinula necator*: ibid., 29, p. 8] was more frequent that downy mildew (*Plasmopara viticola*) [ibid., 29, pp. 7, 8]; combined copper-sulphur dusts proved satisfactory, particularly where copper sulphate treatments had been neglected.

Scab (*Venturia* sp.) seems to be present everywhere on apple [*V. inaequalis*], pear [*V. pirina*], and 'bambinella'.

MILLER (P. R.) & O'BRIEN (MURIEL). **The plant disease warning service in 1949.**— *Plant Dis. Reptr, Suppl.* 188, pp. 297–314, 10 maps, 1949. [Mimeographed.]

Reports received from different parts of Canada and the United States on the spread of potato and tomato late blight (*Phytophthora infestans*), tobacco blue mould (*Peronospora tabacina*), and cucurbit downy mildew (*Pseudoperonospora cubensis*) during 1949 are presented [cf. *R.A.M.*, 28, p. 484]. These diseases were as widely prevalent as in the previous three years, but were generally less destructive.

Potato blight, though reported from numerous localities, was of little economic importance, with losses ranging from a trace to 50 per cent. Tomato blight, unimportant nationally, was severe in several areas, particularly at Leesburg, Florida, and in the Virginia mountain area. In Mississippi the estimated percentage of infection in fields ranged from a trace to 100 per cent., infection in sprayed fields sometimes reaching only 5 or 10 per cent.

Tobacco types affected by blue mould were flue-cured, Burley, cigar-wrapper, Havana seed, broadleaf, and shade. Infection was general over the eastern half of North Carolina. Damage was slight except in the Carolinas and Virginia, where it was severe. Reduction in plants in beds was slight, with an estimated 'high' of 10 per cent., though in several instances 100 per cent. reduction in plant-bed yields occurred, particularly when unsprayed. Prompt application of control measures gave excellent results.

Cucurbit downy mildew was local in Connecticut, local to general in New York, and general in Pennsylvania, Florida, Virginia, Louisiana, South Carolina, Maryland, and Delaware. The estimated percentage of infection ranged up to 100 at harvest and yield reduction up to 75 per cent. The most notable event was the loss of the cantaloupe crop in South Carolina, where most growers omit dusting and spraying. The epidemic was the worst experienced in the state since 1938.

Downy mildew (*Phytophthora phaseoli*) [*ibid.*, 27, pp. 175, 214] of Lima bean [*Phaseolus lunatus*], was reported from southern New Jersey, south-central and south-eastern Pennsylvania, Long Island, New York, and Delaware. The estimated percentage of infection in fields ranged from 5 to 80. Serious losses were reported in New Jersey, while in other areas the highest yield reductions were estimated to be 40 per cent.

Tables appended give the details of spray programmes used and the general results obtained.

Report of Cocoa Conference held at Grosvenor House, London, 30th August–1st September, 1949.—xi+115 pp. 10 pl., 2 diags., 3 graphs (2 col.), 4 col. maps, London, The Cocoa, Chocolate and Confectionery Alliance, Ltd., [1949].

L. J. Schwarz (Association of Cocoa and Chocolate Manufacturers of the United States of America) at the Cocoa Conference held in London in 1949 [cf. *R.A.M.*, 28, p. 276] reported on the progress of the newly formed Inter-American Cacao Centre, Turrialba, Costa Rica [ibid., 28, p. 564] where there is a supervised students' research scheme. H. J. Page spoke on research at the Imperial College of Tropical Agriculture, Trinidad. Much new experimental cacao planting is being done at the River Estate station [ibid., 28, p. 566]. During the year a British West Indies advisory committee has been set up. An outline was given of the work carried out by five panels set up, including one for pests and diseases.

F. W. Cope, speaking on cacao clonal trials at Trinidad, stated that observations suggest that no clone so far tested shows any marked degree of resistance to witches' broom disease (*Marasmius perniciosus*) [ibid., 28, p. 162; 29, p. 14] while some are more highly susceptible than others. Since recording began in 1943 the Trinidad virus disease [ibid., 28, p. 514] has spread widely through CRB 1, has established itself in CRB 2, and appeared in CRB 3. The average effect of virus infection is to reduce the yield by nearly two pods per tree per annum in the first few years of infection. Data are still too scanty to decide whether the decline in yield following infection is linear or whether at some later date the infected tree reaches a new and lower level of fruit production. The rate of decline in yield does not appear to be influenced by the intensity of manuring.

In notes prepared by A. Balleyguier it was stated that swollen shoot disease had affected the following districts in the Ivory Coast [ibid., 25, p. 549]: in the East, areas in Grand Bassam, Abengourou, and Agboville; in the centre around Dalos, Issia, and Sinfra; and in the west, in the Duakoné area of Man. The disease is unevenly spread over these districts and it has been estimated that 1,500,000 trees, mostly on the 2,000 infected acres in Abengourou, should be destroyed; from 1946 to 1947 160,000 trees were removed.

J. Cadbury (Cadbury Bros., Ltd.) gave a paper on the history of the cacao swollen shoot disease [ibid., 28, p. 508] up to 1949 and K. M. Smith (Plant Virus

Research Unit, Molteno Institute, Cambridge) a brief survey of viruses in general. A. F. Posnette (Gold Coast) stated that no alternative hosts of swollen shoot have been found outside the two families Bombacaceae and Sterculiaceae. Control measures are discussed [ibid., 28, pp. 161, 163]. J. D. Broach spoke on cacao rehabilitation in the Gold Coast and P. S. Hammond on conditions there.

Bockmann (H.). **Das Wesen der Fruchtfolgekrankheiten.** [The nature of crop rotation diseases.]—*NachrBl. biol. ZentrAnst. Braunschw.*, 1, 10, pp. 138–140, 1949.

Some of the problems connected with crop rotation diseases in Germany are briefly discussed in relation to their background of environmental factors and cultural practices, with special reference to foot rot of wheat [*Ophiobolus graminis* and other fungi: *R.A.M.*, 13, pp. 153, 569; 16, p. 305; 17, p. 661; 29, p. 93, *et passim*] and club root of cabbage [*Plasmodiophora brassicae*: ibid., 25, p. 147]. As a general principle, a minimum interval of two to three years should elapse between one crop and another of the same or a related plant, or longer if the soil is infested. In the case of *P. brassicae*, moreover, a period exceeding four years is usually required for the natural cleaning of the soil.

In most studies on crop rotation diseases the question of an increase in infestation occupies the foreground, but equally weighty is the matter of its regression. For this aspect of the subject information must be sought on the mode of existence of the soil pathogens in the absence of their hosts, as well as on their longevity. As Wollenweber and Reinking have shown in their monograph on the *Fusaria* [ibid., 13, p. 708], this important approach is virtually unexplored.

Fuchs (W. H.). **Fortschritte der Resistenzzüchtung (RZ) bei Getreide im letzten Jahrzehnt. Sammelreferat.** [Progress in breeding for resistance (RZ) in cereals during the last decade. Collective report.]—*Z. PflZücht.*, 29, 2, pp. 230–239, 1949.

This is a critical survey of the progress made during the last decade in the breeding of wheat for resistance to bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetida*: cf. *R.A.M.*, 17, p. 476], based on 47 contributions to the relevant literature, most of which have been noticed in this *Review*.

Bremer (H.) & Özkan (M.). **Hububat bitkilerinde panaşür ve başak çalikliği.** [On panachure and ear-tipping in cereal plants.]—*Zir. Derg.*, 8, 85, pp. 8–19, 1 pl., 1947. [English and German summaries. Received October, 1949.]

The variegation and ear-tipping of cereals reported by Gassner from Ankara, Turkey, in 1943 (*Phytopath. Z.*, 14, pp. 397–426) were again observed in the same locality in 1944 and 1945. In the former year variegation was very prevalent in wheat, ear-tipping [*R.A.M.*, 23, p. 478] less so, whereas in the latter year ear-tipping occurred alone, affecting chiefly crops sown late the previous autumn. This disorder is characterized by absence of colour and atrophy of the ears or the parts near the tips, and appears from recent observations to be associated with a low April rainfall. Two different forms of ear-tipping seem to have been involved, one resulting from a disturbance in chlorophyll formation in plants grown at low temperatures, and the other, more familiar, caused by an interruption in the water supply during the period of ear development.

Stapp (C.). **Untersuchungen über das Vorkommen der Spelzenbräune des Weizens in Deutschland (vorlaüfige Mitteilung).** [Investigations on the occurrence of black chaff of Wheat in Germany (preliminary note).]—*NachrBl. biol. Zentr-Anst. Braunschw.*, 1, 10, p. 138, 1949.

Between 1944 and 1948 the writer received for identification from south Germany a number of samples of wheat ears with the more or less uniform brown discoloration

and basal shrivelling characteristic of black chaff (*Pseudomonas* [*Xanthomonas*] *translucens* var. *undulosa*). In written reports it was stated that the disease was one of the most serious affecting cereals in the country. The yellow bacteria isolated from the infected samples bore close morphological, cultural, and physiological resemblances to *X. translucens* var. *undulosa*, as described in the relevant literature, but the results of extensive greenhouse and field inoculation experiments, covering a period of five years (up to 1949), were entirely negative. Pure cultures of the black chaff organism were supplied by Dr. A. C. Braun, of the Rockefeller Institute, Princeton, United States, for comparative purposes and were shown by serological experiments to be distinct from the German bacterium. It is concluded, therefore, that true black chaff is not present in Germany and that the disease under observation is not of parasitic origin.

Kakebeeke (W.). **Stuifbrandbestrijding in de praktijk.** [Loose smut control in practice.]—Reprinted from *Cultivator*, *1946*, 14 pp., 12 figs., 1946. [Received November, 1949.]

Various developments in the hot-water treatment of wheat and barley seed-grain for the control of loose smuts [*Ustilago tritici* and *U. nuda*, respectively] are described. A cursory perusal in 1944 of a part of the international literature on the subject yielded a list of 24 different procedures by 15 authors. In Holland [*R.A.M.*, 16, pp. 241, 444] one of the oldest methods is practised, consisting essentially in $1\frac{1}{2}$ hours' pre-soaking in water warmed to a temperature of 18° to 20° C., followed by removal of the sacks, leaving them covered for $4\frac{1}{2}$ hours, and a final 10-minute dip in water at 53° for wheat and 51° to 52° for barley.

The hot-water treatment should be combined with chemical disinfection of the seed-grain to avoid the reduction in germinative energy incidental to the former method. The fungicide may be applied in liquid form either beforehand, during the pre-soaking or immersion in the hot water, or after the latter process, or as a dust to the partially dried seed-grain (not later in the last two cases than two days after the hot-water treatment). Further possibilities of improvement in the existing methods are discussed in the light of experience in other countries.

Stanton (T. R.) & Coffman (F. A.). **Grow disease-resistant Oats.**—*Fmrs' Bull. U.S. Dep. Agric.* 1941, 13 pp., 10 figs., 1 diag., 1949.

In this revision of the Bulletin published in 1943 [cf. *R.A.M.*, 23, p. 97], the distribution, origin, agronomic characters, and performance of new varieties of oats resistant to Victoria blight (*Helminthosporium victoriae*) [ibid., 29, p. 151] in the north-central and north-eastern States and also to stem rust [*Puccinia graminis*], crown rust [*Puccinia coronata*], and smuts [*Ustilago kolleri* and *U. avenae*] are described together with cultural methods including rate and time of seeding, seed treatment, the use of fertilizers and manure, and combine harvesting.

In 1944 and 1945, before Victoria blight became severe, the average yield of the old standard varieties Richland and Gopher (both resistant) was 55·2 bush. per acre, and the new but susceptible Vicland and Tama 67·8, compared with the new resistant varieties Marion (69·7) and Clinton, Mohawk, Benton, and Mindo (76·9). In 1946 and 1947 after blight became severe the average yields for the same groups of varieties were 64·7, 61·9, 72·3, and 75·1 bush. per acre, respectively, Vicland and Tama yielding less than the old varieties.

Leng (E. R.). **Differential reaction to Penicillium seedling disease of Corn.**—*Agron. J.*, 41, 9, pp. 435–439, 2 figs., 1949.

At the Illinois Agricultural Experiment Station during the winter seasons of 1946–7 and 1947–8, 39 dent inbred lines and 24 other types of maize were tested by spore inoculation in the greenhouse for their reactions to the seedling disease caused

by *Penicillium oxalicum* [*R.A.M.*, 18, p. 450; 24, p. 54]. A high degree of resistance was less common than marked susceptibility. Outstanding resistance was shown by the dent inbred line 90 and the sweet inbred 6-355, while the most susceptible types included the dent inbreds WF9, OS420, L289, 187-2, R-4, and a strain derived from Illinois High Protein. Certain inbred lines proved to be somewhat variable in their response to infection, but detailed tests of the resistant line 90 and the susceptible L289 showed that this instability was not a result of genetic differences within the individual selections. Both immaturity and increased age of seed appeared to be capable of reducing resistance to *P. oxalicum*.

Karper (R. E.). **Registration of Sorghum varieties, V.**—*Agron. J.*, 41, 11, pp. 536–540, 1949.

Fourteen new sorghum varieties approved for registration are described, with notes in some cases on their reaction to disease. Midland, Reg. No. 1 (for Kansas and Nebraska), selected from a cross between Pink Kafir and Dwarf Yellow milo, is resistant to milo disease [*Periconia circinata*: *R.A.M.*, 28, p. 331] and 'weak neck' [ibid., 22, p. 429]. Texas Milo and Sooner Milo, Reg. Nos. 83 and 84, are identical with Dwarf Yellow except for their resistance to *P. circinata* [loc. cit.]. Early Hegari, Reg. No. 86, is identical with Hegari except for early maturity, and is now widely grown in Texas and elsewhere. It is susceptible to charcoal rot [*Macrophomina phaseoli*: ibid., 26, p. 140] under environmental conditions favouring small stems, few leaves, and early maturity. Plainsman, Reg. No. 87, and Caprock, Reg. No. 88, both derived from the same milo×kafir cross, are resistant to *P. circinata*, while Martin, Reg. No. 89, originating as a single plant selection in 1937 in a Wheatland field badly infested with milo disease, is outstanding in this respect. By 1940 the seed from this one plant was increased to plant 300 acres, and in succeeding years over 1,000,000 lb. have been distributed annually. Also resistant to milo disease are Double Dwarf White Sooner Milo and Double Dwarf Yellow Sooner Milo, Reg. Nos. 90 and 91 (Early White Milo, S.A. 1170×Double Dwarf Yellow Milo, S.A. 292). Some degree of resistance to [unspecified] foliar diseases and charcoal rot is shown by Sweet Sudan Grass, Reg. No. 92, originating from a cross between Sudan grass and Leoti sorgo back-crossed to the former. Ellis Sorgo, Reg. No. 84 (Leoti×Atlas), is resistant to bacterial leaf spot [*Pseudomonas syringae* (formerly *Bacterium holci*): ibid., 5, p. 547]

Condado (C.), Speroni (H. A.), Banfi (A.), Marquínez Otálora (V. M.), Offerman (A.), Moyano Carreras (N. M.), De Paul Fantini (A.), Fernández Valiela (M.), René Martinez (A.), Ramos Taboada (A.), & Domato (J.). **'Podredumbre de la raicilla' o 'tristeza' de los Citrus: conclusiones arribadas por la Comisión de Técnicos Citricolas.** ['Root rot' or 'tristeza' of Citrus: conclusions reached by the Commission of Citricultural Technologists.] —*Circ. Estác. exp. agríc. Tucumán* 143, 6 pp., 1949.

The report embodying the conclusions of the technologists appointed by the Agricultural Experiment Station of Tucumán, Argentina, to investigate the problem of the 'tristeza' form of root rot in the citrus groves of the provinces of Tucumán, Salta, Jujuy, and Santiago del Estero [estuary] falls into two parts. One prescribes measures for the maximum prolongation in a healthy state of existing plantations grafted on sour orange rootstocks, including legislation to prohibit the entry into the above-mentioned north-eastern provinces of citrus plants or parts thereof (except seeds and fruits without peduncle or leaves) from other zones; rigorous elimination of all plants suspected of harbouring the disease; and extermination of insect vectors.

The second part comprises observations on the reorientation of citriculture through the use of new rootstocks resistant to 'tristeza'. Sweet oranges, while

perfectly satisfactory in this respect, are susceptible to gummosis [*Phytophthora parasitica*, *P. citrophthora*, and *P. palmivora*: *R.A.M.*, 25, p. 557], and should be planted exclusively in permeable, deep soils on high, open ground, at 10 to 20 cm. above soil-level. *Poncirus trifoliata* is well suited to cultivation in the coastal region, but its performance in the north-east is erratic, and technical guidance as to its requirements should be sought. The Rangpur mandarin is markedly precocious, expediting maturity by 10 to 15 days in comparison with other stocks, and thrives on sticky soils. Cleopatra [ibid., 27, p. 521] and Oneco mandarins are reasonably resistant to gummosis and do well on various types of soil. Since some uncertainty prevails in Argentina as to the identity of the true rough lemon [ibid., 28, p. 522], it is necessary to insist on authentic Cape or South African stock. This species is remarkably robust, precocious, and productive, with a strong preference for light soils and intolerant of sharp frosts. It combines particularly well with late oranges and with grapefruit.

Ciferri (R.). **A decline of Citrus plants in Venezuela.**—*Nature, Lond.*, 165, 4184, p. 32, 1950.

During 1949, a disease resembling 'tristeza' [*R.A.M.*, 28, p. 522, and preceding abstract] was observed in commercial citrus plantings in the States of Carabobo and Aragua, Venezuela, affecting sweet oranges on sour rootstocks. Decline of the tops coincides with the decay of rootlets and larger roots.

Haas (A. R. C.). **Mesophyll collapse in Orange leaves.**—*Calif. Citrogr.*, 35, 3, pp. 90, 109–112, 1 fig., 1950.

Further investigations into the causes of mesophyll collapse in Valencia orange leaves [*R.A.M.*, 23, p. 224] at the Citrus Experiment Station, California, indicated that severe soil moisture stresses, without the addition of large excesses of soluble salts to the soil, can induce this physiological disorder. The author considers that the effect of salts is similar to that of moisture stress and is not one of ionic unbalance. Moisture stresses in soil cultures of Valencia orange cuttings were induced by bringing the soil moisture percentage to near the field capacity and then allowing it to decrease before returning it to the former level. The cuttings grew better when the soil-moisture percentage was maintained close to the field capacity. The results show that adequate irrigation, which tends to improve the size of the fruits, is helpful in eliminating mesophyll collapse.

Kiely (T. B.). **Preliminary studies on Guignardia citricarpa, n.sp. : the ascigerous stage of Phoma citricarpa McAlp. and its relation to black spot of Citrus.**—*Proc. Linn. Soc. N.S.W.*, 73, 5–6, pp. 249–292, 7 pl., 11 figs., 1948.

This is the full account of the author's studies on *Guignardia citricarpa* [*R.A.M.*, 28, p. 454], a shorter version of which has already been noticed [ibid., 27, p. 562]. The globose, subepidermal, finally erumpent, perithecia are carbonaceous dark brown by transmitted light; they develop from a pycnidio-sclerotium. When solitary they measure 125 to 135 μ in diameter, in groups of two 220 to 240 μ, and three, 340 to 360 μ. The perithecial wall is 20 to 22 μ thick and the ostiole 14 to 16 μ in diameter at maturity. Clavate, cylindrical, eight-spored asci, 45 to 60 in number, arise from the base of perithecium and measure 50 to 85 by 12 to 15 μ. The spores are at first uniseriate, becoming biseriate at maturity. Hyaline to granular, usually non-septate, grey ascospores 8 to 17·5 by 3·3 to 8 μ, usually with one large central guttule at maturity, have a small, round, clear gelatinous cap at each end.

The air-borne ascospores, which are emitted from both surfaces of decaying citrus leaves, but never develop on the fruits, do not require special conditions for germination. After 48 hours at 25° C. 70 per cent. had germinated, and after 96 hours 98·6 per cent. During germination appressoria of various sizes are pro-

duced terminally on the germ-tube. Glasshouse inoculations of young fruits of Valencia and Washington Navel oranges, kumquat, and Sweet Rind lemon with ascospores resulted in infection of the latter only; when inoculated leaves of rough lemon seedlings grown in the glasshouse were removed and allowed to wilt, a profuse development of the fungus occurred. Inoculations of mature Valencia fruits free from latent infections gave negative results.

The pycnidiospores possess a gelatinous appendage which is probably derived from the histolysis of the thin-walled pseudo-parenchymatous tissue of the pycnidium. Experiments demonstrated that they are water-borne. They appear to be possible sources of infection only during the development of virulent lesions on the mature Valencia fruit and cease to be such once the affected fruits drop. The results of germination experiments suggested that moisture conditions at the time of pycnidiospore formation influence their germination ability. Daily wetting and drying appear to be necessary to produce the maximum yield of viable spores. The addition of citric acid (at concentrations 0·5 to 0·1 per cent.) stimulated germination. Pycnidiospores were very short-lived; after four days' storage the mean figure for germination dropped by 60 per cent., and after one month they had lost their viability. Inoculations with pycnidiospores on immature fruits in the glasshouse produced lesions in sweet rind lemons only. The pathogenicity of pycnidiospores under field conditions was confirmed in inoculation experiments using young fruits of Valencia oranges, protected with paper bags against natural infection.

Primary infections of the young leaves are initiated by wind-borne ascospores during September and October and of the young fruits from October to about February. Latent infections on green leaves provide ascospore inoculum, whenever such leaves may fall, over a period of one to about three years. Primary latent infections of the young fruits will give rise to pycnidiospores (after 12 to 15 months), and at maturity they will develop black spot lesions, which in turn can initiate the secondary infection cycle.

A description of a standard technique for testing green citrus leaves for the presence of latent infections is appended.

Colletotrichum gloeosporioides also exists as a latent infection in citrus leaves, particularly in young leaves of lemon and grapefruit. Acervuli of this fungus will develop on the dying leaves without preliminary wilting.

De Carvalho (T.). **A mancha preta da fruta citrina (Phoma citricarpa McAlp).** [Black spot of Citrus fruit (*Phoma citricarpa* McAlp.).]—*Gaz. Agric. Moçambique*, 1, 5, pp. 95–102, 6 figs., 1949.

The available information on the economic importance, symptomatology, geographical distribution, predisposing factors, and control of citrus black spot (*Phoma* [*Guignardia*] *citricarpa*) is summarized in connexion with its detection about four years ago at the Umbeluzi Experiment Station, Mozambique [*R.A.M.*, 29, p. 89], and more recently in other parts of the Colony, on orange, tangerine, lemon, and grapefruit. Growers are advised to harvest the fruits at the earliest possible date and not to procure material for new plantings from any nursery or locality where the disease has been observed. Spraying experiments with Bordeaux mixture and other fungicides, as recommended in South Africa [ibid., 28, p. 564], have so far given negative results, but a further series is in progress under improved conditions and using new combinations of fungicidal mixtures.

Sundaram (S.). **Breeding for resistance to pests and diseases in Arabica Coffee.**—*Plant. Chron.*, 44, 24, pp. 659–661, 1949.

The author in discussing resistant varieties of coffee in India mentions a strain of Arabic S–288, resistant to *Hemileia vastatrix*, which is being distributed from the Research Station, Balehonnur [cf. *R.A.M.*, 28, p. 572]. Work has been started on

a population of natural (Devamachi) hybrids from Arabica and Robusta, found growing near Sidapur. These have been back-crossed to Kent's Arabica or suitable Robusta strains and new forms are being built up. Optimal conditions for raising rooted cuttings on a large scale are being worked out. [This article is reprinted from *Mon. Bull. Indian. Coffee Bd*, 13, 11, 1949.]

Thomas (K. M.). **First Annual Report of the Research Department of the Indian Coffee Board (1947–48).**—*Bull. Res. Dep. Indian Coffee Bd* 1, 38 pp., [? 1949]. R. 1.

In comparative spraying tests carried out in southern India from 1945 to 1948, inclusive, on the control of coffee leaf disease (*Hemileia vastatrix*) [see preceding abstract] by Bordeaux mixture applied at various concentrations with and without a spreader, concentrations over 2–2–40 did not give any significantly higher yields than one of 2–2–40, and the addition of linseed oil spreader also had no significant effect on yield. In another series of tests pre- and post-monsoon applications of Bordeaux mixture gave, in most cases, better yields than pre-monsoon applications only, or post-monsoon only. The addition of teepol X spreader ($\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ oz. per 40 gals.) to Bordeaux mixture (2–2–40) increased leaf retention, though at the highest strength teepol reduced yield as compared with the two lower strengths. Small-scale field trials were conducted in 1947 to estimate the relative merits of Bordeaux mixture and perenox (1, $\frac{3}{4}$, and $\frac{1}{2}$ lb. in 40 gals.) against *H. vastatrix*. In three counts the numbers of Bordeaux-treated leaves shed, presumably as a result of infection, were 11, 5, and 6 per plant, and the numbers of pustules on the surviving leaves were 113, 32, and 47. The corresponding figures for perenox were 14, 11, and 14 and 297, 232, and 444 pustules. In another experiment leaf counts (1946 to 1948, inclusive) showed perenox to be equal to Bordeaux mixture in three out of four observations; in the fourth perenox at 1 lb. and $\frac{1}{2}$ lb. was inferior to Bordeaux mixture, but at $\frac{3}{4}$ lb. was equal to it.

Estates in certain localities in the heavy south-west monsoon areas, e.g., the Jagar Valley, continue to report severe infection from black rot (*Corticium koleroga*) [ibid., 29, p. 26].

Progress Reports from Experiment Stations, season 1947–48.—137 pp., 2 diags., London, Empire Cotton Growing Corporation, 1949.

In the plant pathology section of the report from Barberton, South Africa [cf. *R.A.M.*, 27, p. 472], G. M. Wickens states that in all fields periodically mapped there has again been observed a tendency for aggregation of wilt disease (*Verticillium dahliae*) into areas of relatively high incidence close to the sites where disease occurred in the previous season, but without any neighbour-to-neighbour spread. The main increase occurred in areas of good plant growth and also adjacent to *Cassia siamen* windbreaks. There was no evidence that roguing affected the total amount of disease or the rate of development. Natural infections were found on sunn hemp (*Crotalaria juncea*) [ibid., 26, p. 451]. The symptoms were a rather patchy, bright yellow leaf chlorosis and flaccidity, with pale brown vascular discoloration. There was no external discoloration as in *Fusarium* wilt where the leaves are flaccid and dull green, the vascular tissues and sunken streaks on the stem being dark brown to purplish brown. Seed lots from severely diseased cotton plants, both naturally and artificially infected, gave rise to healthy vigorous plants. Stripping the stem of flowers and buds before wound-inoculation with *V. dahliae* at base increased the reaction to inoculation and emphasized the differences in susceptibility between different lines. U. 4/5143, M.U. 8A, A 2106, and BP 50/3 were found to be highly susceptible, B. 181 resistant, and BP. 52 intermediate in reaction. More confidence is now felt in the stem-wound inoculation method for comparing susceptibility.

In plants sprayed with inoculum of *Xanthomonas malvacearum*, leaf lesions on four strains of the b_2 b_2 genotype appeared earlier, retained the oily appearance of early lesions for a longer period, were larger, and when fully developed paler and with exudate showing more commonly on the lower surface of B_2 B_2 counterparts. There was no sign that, in the bacterial boll rot phase, strains carrying B_2 were less affected than those with b_2. Under Barberton conditions good yields may be obtained, even from susceptible types, in spite of heavy infection by the pathogen. The natural incidence of the disease was higher than ever previously recorded and occurred freely in normally resistant varieties such as U. 4/5143 and M.U. 8A. Blackarm attack was very slight to nil in *Gossypium raimondii*, *G. anomalum*, and *G. davidsonii*. Bacterial boll disease was particularly severe in A. 5805–06, an M.U. 8A × Tidewater hybrid.

In experiments on internal boll disease (*Nematospora gossypii*), staining of bolls inoculated when four-weeks old was least in M.U. 8A because this variety passes through its vulnerable early stage of high water content more rapidly than the other lines. In this variety the mean percentage loss in weight as a result of inoculation was 34·7, dry matter at the time of inoculation was 17·1 mean per cent., and mean of mean maturation periods 64·7 days, compared with 60·5, 12·9, and 78·1, respectively, for A. 2106. Significant differences in degree of damage from inoculation of different varieties at one chronological age are entirely attributable to differences in rates of physiological development. The greatest likelihood of promoting potentiality for escape from the disease at present seems to lie in the promotion of a steep fruiting curve. The mean number of days from planting to the splitting of half the developed bolls for M.U. 8A is 153·5.

S. H. Evelyn at the Gezira Station, Anglo-Egyptian Sudan, reports the commerical success of D.S.1., known as Evelyn's Sakel. Its susceptibility to blackarm and leaf curl [cotton leaf curl virus] is no greater than that of Main Crop. Seed produced at the Gash is enough for sowing 30,000 acres in the Gezira next season. The blackarm-resistant Domains Sakel B[lack] A[rm] R[esistant] 14/1 gave a yield of over 1,890 lb. seed cotton per acre in small bulk plot at Abdel Magid. Bulked material of four selections resistant to leaf curl, R[esistant] D[omains] S[akel] 1/47, 2/47, 3/47, and 4/47 showed very high resistance, with 0, 2, 4, and 0 per cent. infection, respectively, at the end of flowering and 18·5, 10·5, 24, and 19·2, at the end of picking compared with 49 and 67 per cent. and 8·35 and 100 per cent., respectively, for BAR.14/1 and the commerical strains. Leaf curl infection in progeny rows of the same four selections was 39·1, 33·3, 26·1, 21·7 compared with 100 per cent. in Domains Sakel. A striking feature of the R.D.S. progenies is the very slight degree of infection shown when the plants do get the disease. A few BAR. 14/1 plants which showed high resistance are being carried forward. In an experiment to determine the degree of resistance actually present in X 1730A, 53 plants at Gezira showing a fairly severe attack of leaf curl were selfed and the resultant seed used as spreader material among test strains. Since 1935–6 there has been no case of leaf curl in X 1730A at Tokar, whereas at Shambat it is susceptible. There was no significant difference in infection between the strains and X 1730A, which had 46·2 per cent. at $6\frac{1}{2}$ months and 58 per cent. two months later. The results confirm that X 1730A and its blackarm-resistant counterparts are highly resistant under Gezira conditions but not under conditions favourable to infection.

At the Shambat station R. L. Knight reports that advantage was taken of the season's high incidence of leaf curl to select within BAR. 14/7 for resistance to this disease. After roguing, disease-free plants were cut back hard and are being rogued regularly, such as remain are to be bulk picked for use as a first line of partially resistant BAR. 14/7. One of five back-cross progeny from tetraploid [*G.*] *herbaceum* (Wagad 8), which showed marked blackarm resistance, has yielded 50 seeds on

being pollinated with Sakel pollen. BAR. 1730L, BAR. 4/5, and BAR. 4/11, blackarm resistant strains of X. 1730, have been produced in bulk. BAR. SP. 84 has been accepted as the commercial type for the rain areas of the Southern Sudan. Of imported Upland types 20 per cent. of 216F showed typical B_2 resistance; 8 per cent. of L.S.S. showed similar resistance, while 90 per cent. showed resistance equal to or better than a B_2 B_3 combination; Victory, 268F, 199F, and KP. 28 had resistance equal to B_2 B_3, and 244F more than a B_2 Upland but less than the others.

M. F. Rose reports that at the Kadugli Station BAR. SP. 84 material, derived from the 'filter' of the 504 single plants selected from the parental bulk in 1946, was grown under test and sprayed twice with blackarm suspension. All derivatives responded well and much valuable material is on hand for future selection work. BAR. SP. 84 proved superior to P.S.S. in yield of lint per acre; it is very early and is therefore most suitable for 'harig' cultivation, is blackarm- and jassid-resistant, and has a high ginning out-turn. Blackarm on the Kamina farm spread through susceptible material. All resistant strains were severely tested in one of the worst seasons recorded.

Twelve single plant lots (Kadugli 1–12) of cowpeas (*Vigna sinensis*) [*V. unguiculata*: cf. ibid., 26, p. 524] and three small special bulks were planted out late, 12th July, with surrounding belts of bulked local material susceptible to an undetermined virus disease. All mid-season and late types were nearly immune, but of the early only Kadugli 4 showed any degree of resistance. All resistant types are being bulked as quickly as possible.

The Red and White varieties of the sesame crop were attacked just before flowering by a disease known locally as Marad el Dam, which eventually swept through the Red giving 100 per cent. infection. It had every symptom of a virus disease and was marked by a darkening and thickening of the leaf lamina and a reduction in width, with convexing along the midrib; flower buds were replaced by vegetative shoots with sterile green flowers [ibid., 15, p. 396]. Infection of the Red strain was 100 per cent. and seed yield 45 lb., the figures for the White being 43·7 per cent. and 354 lb., respectively. From the White strain 98 single plants showing no symptoms were selected.

From the Lake Province, Tanganyika, J. E. Peat and A. N. Prentice report that from a comparison of high yielding, fairly heavily attacked cotton strains, susceptible to blackarm, with high yielding, resistant ones it is concluded the loss of crop might be around 20 per cent.

From the Domira Bay Station, Nyasaland, H. C. Ducker reports that the T. 22 lines have been shown by R. L. Knight at Shambat to be homozygous for B_2 resistance factor. There are, however, even on varieties known to contain B_2, exceptional attacks of a disease which resembles blackarm.

Arny (A. C.). **Registration of improved varieties of Flax, IV.**—*Agron. J.*, 41, 11, pp. 534–535, 1949.

Two new registered varieties of flax developed at the Minnesota Agricultural Experiment Station [cf. *R.A.M.*, 24, p. 504] are described, namely, Dakota C.I. 1071 Reg. No. 8 [ibid., 27, p. 185], and Minerva C.I. 1081 Reg. No. 9. Dakota, a selection from a cross between Bison and Renew, is immune from the races of rust (*Melampsora lini*) prevalent east of the Rocky Mountains, moderately resistant to wilt (*Fusarium lini*), and similar to Bison [resistant] in its reaction to 'pasmo' (*Sphaerella linorum*). It is available and recommended for cultivation in North and South Dakota, Montana, Iowa, and Canada [ibid., 29, p. 80]. [In a footnote it is stated that rust was found on Dakota in a few late-sown fields in North Dakota in 1948, and in a number in the same State and Minnesota in 1949.]

Minerva, derived from a cross between Bison and Light Pink, is resistant to wilt and to most of the races of rust commonly occurring in North America, while

its reaction to *S. linorum* approximates to that of Bison. It has been distributed for cultivation in central Minnesota and the Red River Valley.

Wahlin (B.). **Nya parasitangrepp på Oljelin.** [New parasitic attacks on Linseed Flax.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1948*, 6, pp. 88–90, 1948.

Linseed flax cultivation is on the increase in East Gothland, Sweden, the area occupied by the crop in 1948 having covered 9,500 ha. as compared with 5,103 in 1945. In general, it is reasonably free from fungal diseases and insect pests, but with the extension of the crop a new pathogen has appeared, namely, *Alternaria linicola* [*R.A.M.*, 25, p. 582]. *Fusarium* [*lini*] and other parasites of seedlings can be controlled by seed treatment [ibid., 25, p. 501]. Rust (*Melampsora lini*) [ibid., 24, p. 102] is relatively infrequent, occurring only on low-lying or shut-in sites.

Krüger (E.). **Untersuchungen über zwei der bedeutendsten Leinparasiten–Colletotrichum lini Manns et Bolley und Septoria linicola (Speg.) Gar. (Sphaerella linorum Wr.).** [Studies on two of the most important Flax parasites—*Colletotrichum lini* Manns & Bolley and *Septoria linicola* (Speg.) Gar. (*Sphaerella linorum* Wr.).]—*Arb. biol. Anst. (Reichsanst.), Berl.*, 23, 2, pp. 163–188, 16 figs., 3 graphs, 1941. [Received October, 1949.]

The author's studies on two severe pathogens of flax in Germany, namely, *Colletotrichum lini* [*C. linicola*] and *Sphaerella linorum* [*R.A.M.*, 18, p. 315] in its conidial state, were concerned with the morphology and physiology of the organisms, varietal reaction tests, and possibilities of control.

During the two years covered by the observations, sporulation in all isolates of both species (six of *C. linicola* and four of *S. linorum*) pursued an entirely erratic course after the first few days on artificial media. Conidial dimensions, too, showed a wide range of variation under these conditions. The optimum temperature range for spore germination in both species lay between 19° and 26° C. and for vegetative growth at 24°. The development of setae in *C. linicola* was promoted by low atmospheric humidity.

Two of the 93 varieties and strains comprised in the resistance tests proved highly resistant to both fungi, viz., 'unknown 5' and Tirol 3. The breeding of resistant forms appears to offer some promise as a means of control, while experiments are also in progress in connexion with the development of a method of seed disinfection free from the disadvantages incidental to both liquid treatments and dusting.

Goulden (C. H.) & Stevenson (T. M.). **Breeding for disease-resistance in Canada. Part II. Flax and forage crops.**—*Emp. J. exp. Agric.*, 17, 68, pp. 222–228, 2 pl., 1949.

Continuing their survey on breeding for disease resistance in Canada [cf. *R.A.M.*, 28, p. 622], the authors and collaborators describe the progress achieved in breeding for resistance to the principal diseases of flax, forage crops, and legumes, especially to lucerne bacterial wilt (*Corynebacterium insidiosum*) [ibid., 29, p. 80], winter crown rot [ibid., 27, p. 527], and black stem (*Ascochyta imperfecta*) [ibid., 28, p. 293], and to clover crown rot (*Sclerotinia trifoliorum*) [ibid., 22, p. 240], which appears to be the major disease of red clover in Eastern Canada.

As a result of the breeding programme for resistance to flax rust (*Melampsora lini*) [ibid., 25, p. 61] carried out at Ottawa in co-operation with the Laboratory of Plant Pathology, Winnipeg, the variety Rocket from Argentine 8c × Redwing was distributed in spring, 1947, and Sheyenne, an early variety from Nuda × Ottawa 770B from the North Dakota Experiment Station, was licensed for sale in Canada. Flax disease surveys made at the end of August, 1945, onwards, show that pasmo

(*Sphaerella linorum*) has increased in range and severity each year, appearing in Saskatchewan for the first time in 1946. Crystal, C.I. 1116, and C.I. 1153 were more tolerant of the disease than the other varieties tested. At present the flax breeding project includes the use of backcrosses to C.I. 1116 and C.I. 1153, which possess resistance to rust and wilt (*Fusarium oxysporum* f. *lini*) [*F. lini*], as well as to pasmo.

Climax Timothy [*Phleum pratense*], recently produced by the Division of Forage Plants, Central Experimental Farm, Ottawa, is comparatively free from the common leaf diseases and is superior to commercial varieties.

Lucerne virus diseases, of which witches' broom is typical, are more commonly found in British Columbia than in other provinces. Leaf spot diseases, of which *Pseudopeziza medicaginis* is the most common pathogen, have a general distribution and cause variable losses. Root rot (*Sclerotinia* spp.) produces minor losses by thinning out stands in Eastern Canada. Lucerne, however, is more resistant to this disease than red clover. Recently considerable concern has been aroused among growers of single-cut red clover in Alberta by a recent outbreak of northern anthracnose, caused by *Kabatiella caulivora* [ibid., 28, pp. 18, 116]. An active breeding project to develop resistant strains has been started at the Dominion Experimental Station, Alberta. In 1946 the bacterial wilt nursery at the Lethbridge Experimental Station [ibid., 28, p. 442] contained eight wilt-resistant clonal lines from the Dominion Forage Crops Laboratory, Saskatoon, 25 from the University of Wisconsin, and 21 from Lethbridge. In 1947 and 1948, several hundred clonal rows selected for resistance to black stem and crown rot, high seeding capacity, rhizome development, and good survival in old fields, were established in the wilt nursery to undergo tests, and some are expected to be available for Canadian production before long.

Many of the losses in red clover attributed to winter-killing are known to be caused by *Sclerotinia trifoliorum*. This was borne out at Ottawa where winter survival in nursery material averaged 88 per cent. but the yearly survival averaged 46 per cent. Many plants made a few days' active growth in the early spring and then died. An examination of these plants and of the 12 per cent. formerly classified as winter-killed showed typical *Sclerotinia* in the crowns. The double-cut variety Ottawa produced by the Division of Forage Plants has considerable resistance to crown rot, the yearly survival in 1947 being 15 per cent. higher than Totin (from Norway) the next most resistant variety in the test.

Van Klaveren (C.). **Ziekten in bloembollen.** [Diseases in bulbs.]—*Maandbl. LandbouwVoorl.*, 6, 3–4, pp. 147–153, 1949.

Sclerotium tuliparum continues to cause extensive and severe infection of tulips in Holland [*R.A.M.*, 29, p. 141] and its control presents great difficulties, since the sclerotia persist for years in the soil and are readily disseminated, e.g., by ploughing. Reinfection from this source may occur after four or five years. Brassicol [ibid., 28, p. 554] gives effective, though generally not absolute, control of *S. tuliparum*, but it is not cheap and its action depends on its regular distribution through the topmost 10 cm. of the soil. It should be applied shortly before lifting, preferably with a drill, when the ground is not too damp, at the rate of 75 gm. per sq. m. mixed with a fair amount of dry sand. *S. perniciosum* [ibid., 10, p. 32] occurs in patches mainly in heavy soils, on which its white mycelium is conspicuous. The bulbs are not destroyed but are backward in growth. The small, black sclerotia of the pathogen adhere firmly to the bulbs and the stem remains. They may easily be confused with those of *Botrytis tulipae* [ibid., 8, p. 40], but the latter never develops in patches, nor is its mycelium visible on the ground. In warm, sultry weather the areas infected by *S. perniciosum* extend rapidly and should be eradicated at the first opportunity. The sclerotia, like those of *S. tuliparum*, are readily disseminated by cultural operations and can cause reinfection after many years.

The bulbs may advantageously be treated with aretan or germisan (0·25 per cent., two hours' immersion) or 5 per cent. formalin (ten minutes).

Factors contributing to the development of *B. tulipae*, such as dense planting, an unduly low storage temperature, and damage from late frosts or injuries inflicted during cultural operations, should be avoided. Protective spraying should be carried out, e.g., with 1·2 per cent. shirlan, 0·2 per cent. fermate with a good spreader, 0·8 per cent. tulisan [ibid., 19, p. 195], or 0·8 per cent. OB 72. The first application should be made when the shoots are about 10 cm. above soil-level at the rate of 14 l. per acre, which may be increased for the later treatments to 18 to 20 l. Two or three sprays should be given at 10- to 14-day intervals before, and the same number after, flowering. Very satisfactory control of 'fire' may be effected in this way, frequently accompanied by increased yields of 40 to 70 kg. per acre.

The 'Augusta' disease, of obscure etiology [ibid., 29, p. 141 and next abstract], is signalized by very irregular emergence of the tulip shoots, some of which, in fact, remain in the ground. The bulbs are brown and speckled. In a note on the tulip-breaking virus carried by *Myzus persicae*, growers who cultivate the very popular 'broken' varieties are urged to keep them rigorously isolated from other plantings. Lilies also harbour the tulip breaking virus [ibid., 28, p. 174].

Irises, like tulips, are attacked by *S. tuliparum*, the initial symptoms of which, however, are less conspicuous in iris and are likely to be missed, resulting in a greater likelihood of spread. The [mosaic] virus appears on iris leaves in the form of grey stripes and spots. By means of systematic selection during the last few years the virus has been eliminated from 95 per cent. of the iris stocks [cf. ibid., 16, p. 728]. *Heterosporium gracile* [*Didymellina macrospora*: ibid., 28, p. 524] may cause heavy damage on irises in the summer. Infection by *S. delphinii* [ibid., 8, p. 382] presents many analogies with the foregoing and occurs at the same time of year. The reddish-brown sclerotia of *S. delphinii*, however, are a distinguishing feature. This species also persists in the soil and on the bulbs after lifting, continuing to infect them in storage unless they are properly dried. The ground should be thoroughly cleansed and disinfected before replanting by the methods prescribed for the control of *S. tuliparum*.

De Bruyn Ouboter (M[aria] P.) & Van Slogteren (E.). **Het Augusta-ziek der Tulpen een virus-ziekte van het Tabaksnekrosetype.** [The Augusta disease of Tulips a virus disease of the Tobacco necrosis type.]—*Tijdschr. PlZiekt.*, 55, 5, pp. 262–271, 4 pl., 1949. [English summary.]

Sporadic outbreaks of an undescribed disease of tulips, known as 'Augusta disease' from the variety first extensively affected, have been observed in Holland [see preceding abstract] since 1928, but only in 1931 was the resultant damage of economic importance. The etiology of the disease remained obscure until it was found to correspond to the English descriptions of tobacco necrosis virus [*R.A.M.*, 14, p. 797; 25, p. 188; 28, p. 290]. During the war of 1939 to 1945 the increased cultivation of potatoes and tobacco, both hosts of the virus, in the bulb-growing areas was accompanied by an intensification of the tulip disease, but of recent years there has been a regression in its incidence, possibly due to the discontinuance of tobacco cultivation and a reduction in the use of potatoes in the rotation.

Baker (K. F.), Dimock (A. W.), & Davis (Lily H.). **Life history and control of the Ascochyta ray blight of Chrysanthemum.**—*Phytopathology*, 39, 10, pp. 789–805, 3 figs., 1949.

Ray blight of *Chrysanthemum morifolium* (*Ascochyta chrysanthemi*) was first observed by F. L. Stevens in North Carolina in 1906 (*Bot. Gaz.*, 44, pp. 241–258, 1907), and since that time has caused severe losses in the State. The disease has further been reported from South Carolina, Mississippi, Florida, and Maryland,

while the fungus was also isolated from dead stem bases of commercial plants in California, where natural flower infections are not known to occur, and gave positive results in inoculation experiments.

Pycnidia are produced on petals, stems, or leaves under conditions of variable moisture and temperature. Conidia are exuded in gelatinous masses and are disseminated by water; at laboratory temperatures they germinate in $3\frac{1}{2}$ to 4 hours and infect petals in just over six. Once established in the tissue the fungus will continue to grow and cause decay of the flower in a relatively dry atmosphere over a temperature range of 6° to 30° C., its development being particularly luxuriant from 20° to 26°, with an optimum at 24°. Pycnidia are formed in the petals within 13 days after infection. A very high biotic potential is maintained by the ray blight fungus during the growing season.

The black, globose perithecia, 96 to 224 (mean 146) μ, with a papillate ostiole, of the hitherto undescribed perfect state of *A. chrysanthemi*, herein designated *Mycosphaerella ligulicola* n.sp., are rapidly and profusely formed in the late summer and autumn on infected stems, flowers, and foliage under exceptionally arid as well as in humid conditions. The fasciculate, obclavate, shortly stipitate asci, 49 to 81 by 8 to 10 (63 by 9) μ, contain eight elliptico-fusoid, uniseptate, hyaline to pale green, guttulate ascospores, 12 to 16 by 4 to 6 (14 by 5) μ. The perithecia appear to supply much of the primary inoculum for the infection of developing buds and flowers during the autumn and winter. Overwintering is also effected by means of the mycelia or pycnidia.

Owing to its wide tolerance of temperature and moisture, *M. ligulicola* would appear to be a potentially dangerous parasite over a much more extended area than its present range. Cultural practices designed to reduce the persistence of infective matter from one growing season to the next and to keep the budding or flowering plants dry may assist in the control. All debris should be deeply ploughed under in the autumn, the stems and leaves of cut flowers burnt or buried, and a minimum of two years' crop rotation practised. Propagation should be effected exclusively by tip cuttings from plants grown under glass or other rainproof cover and irrigated so as to preclude splashing water. Weekly applications of parzate ($\frac{3}{4}$ lb. per 100 gals. plus a good spreader) up to flowering time have given promising results in the field.

Jørstad (I.) & Roll-Hansen (F.). **Urtica dioica an aecidial host of Puccinia iridis.**—*Nyt Mag. Naturv.*, 87, pp. 61–75, 3 figs., 1949.

Puccinia iridis [*R.A.M.*, 19, p. 168; 21, p. 81; 26, p. 421, *et passim*], collected in the teleuto stage for the first time in Norway on *Iris sibirica* near Oslo in 1944, was shown by reciprocal cross-inoculation experiments to be heteroecious, with *Urtica dioica* as an alternate (aecidial) host, the use of which appears to be obligatory under local conditions. The uredospores were smaller (18·5 to 29 by 17 to 23·5 μ) than usual for iris rust, but comparable with those in herbarium specimens of *I. graminea* and *I. ruthenica* from abroad.

Chevalier (A.). **Sur la biologie d'une plante se rapprochant du vrai Oenothera lamarckiana Ser., les variations de celui-ci et les viroses et bactérioses des Oenothera's.** [On the biology of a plant resembling the true *Oenothera lamarckiana* Ser., its variations, and the viroses and bacterioses of *Oenothera*.]—*C. R. Acad. Sci., Paris*, 229, 2, pp. 93–95, 1949.

The remarkable instance recently described of a mutation of virus origin in *Cymbalaria* [*R.A.M.*, 28, p. 628] led to the study of a similar phenomenon in *Oenothera*. In the spring in 1949, all the basal leaves on most of the plants of a biennial species, regarded as new and named *O. lutetiana*, in an experimental plot at the Jardin des

Plantes, Paris, were dented, folded, and warped, with protuberant blisters on the upper surface; later the stem leaves became similarly affected. In June the basal leaves of some of the plants developed confluent, yellowish-green spots, forming a mosaic pattern, and the suspicion of a virosis was thereby confirmed.

Sunflower growing for seed.—*Banana Bull., Sydney*, 13, 147, p. 2, 1949.

In connexion with a project, sponsored by the Department of Agriculture and Stock, for extended commercial sunflower cultivation in Queensland, it is stated that December and January plantings are often subject to rust [*Puccinia helianthi*].

Kuntay (S.) & Bremer (H.). **Bir çayir otunda eveil hayvanlari zehirleyen mantar.** [A parasitic fungus in a pasture grass poisoning livestock.] –*Zir. Derg.*, 8, 86, pp. 4–6, 1 fig., 1947. [English summary. Received October, 1949.]

Claviceps paspali was observed in 1946, for the first time in Turkey, on *Paspalum distichum* [*R.A.M.*, 28, p. 404] in south-western Anatolia, where grazing livestock were poisoned. Brief notes are given on the symptoms, geographical distribution, and hosts of the fungus, together with directions for the prevention and cure of its toxic effects on stock [ibid., 20, p. 23].

Darpoux (H.) & Vuittenez (A.). **Rôle des périthèces de Venturia pirina dans la région parisienne. Influence de l'élimination des feuilles mortes par le bêchage sur l'intensité des premières contaminations et sur l'évolution ultérieure de la tavelure du Poirier.** [Rôle of the perithecia of *Venturia pirina* in the Paris area. Effect of eliminating dead leaves by digging in upon the intensity of the first infections and on the subsequent development of Pear scab.]—*C.R. Acad. Agric. Fr.*, 36 [? 35], 14, pp. 592–594, 1949.

Three lots of 30 pieces (44 sq. mm. in area) cut from dead leaves of untreated Doyenné du Comice pear trees from the vicinity of Paris bore, respectively, on an average 784, 257, and 667 perithecia per piece of *Venturia pirina* [*R.A.M.*, 27, p. 529; 28, p. 461] and *Mycosphaerella sentina* [ibid., 27, p. 425], the two being present in about equal numbers.

Potted Passe Crassanne pear trees, forced in a greenhouse, were laid on dead leaves in an orchard during rain when ascospores were being freely liberated. Numerous lesions developed when the trees were put back in the greenhouse. One tree showed infection of every leaf and fruit, with 608 lesions on 70 leaves and 88 on 16 fruits. Trees placed at a distance of 30 m. from the orchard at the same time remained unaffected.

Dead leaves were dug into the ground, over half an orchard, while in the other half they were left lying on the ground. All the trees were given five applications of various fungicides. After five discharges of ascospores the average number of lesions per 100 leaves in the uncleared half ranged from 18·5 to 208·8, for the different treatments, (1149 for the untreated), the corresponding figures in the part where the leaves were buried being 2·3 to 72·5 and 230·9. The best control in both parts was given by 1 per cent. Bordeaux mixture.

Moore (M. H.). **Note on the association of Botrytis cinerea with an Apple canker, and with various symptoms on sundry other hosts.**—*Rep. E. Malling Res. Sta., 1948*, p. 101, 1 pl., 1949.

In 1948, losses occurred in one- to two-year-old Cox and Worcester apple trees in Kent through cankers associated with *Botrytis cinerea*, which appeared to have entered where lateral shoots had been removed close to the stem. Sometimes the fungus had developed under protective sacking bands which apparently provided

ideal conditions for the fungus to flourish on the cut surfaces before they healed. It also occurred where there was a lush cover crop and also where soil had been earthed-up over wounds. A similar disease was observed on young pears.

The cankers were mostly accompanied by flaking of the usually dull red bark. Sometimes the stem above the cankers, several of which can occur on one stem, was killed. Older, dry cankers were sharply defined from the adjoining healthy tissue by longitudinal cracks where the smooth-barked lesion had become sunken. Fresh cankers readily produced abundant *B. cinerea* type growth on incubation in moist air, though old, dry cankers required much longer, and developed little or no aerial growth of the fungus.

Similar cankers, from which *B. cinerea* was readily obtained in pure culture, were found on *Prunus besseyii* and Japanese quince (*Chaenomeles cathayensis*). Other examples of an association of *B.* [*? cinerea*] with symptoms which leave small doubt of its pathogenicity are cited. Dry eye rot (*B. cinerea*) [ibid., 23, p. 26] was observed on Edward VII apple fruits.

Larsh (H. W.) & Anderson (H. W.). **Bacterial spot of stone fruit: with special reference to epiphytotics and dissemination of the causal organism.**—*Bull. Ill. agric. Exp. Sta.* 530, pp. 31–55, 2 figs., 2 graphs, 1948. [Received April, 1949.]

Studies in Illinois on *Xanthomonas pruni* [*R.A.M.*, 28, p. 463] showed that primary foliage infection on peach trees originates in twigs with spring cankers [ibid., 13, p. 172] or terminal die-back where the pathogen overwinters. *X. pruni* is disseminated by wind, rain, and dew, and the extent of spread depends largely upon temperature (optimum 24° to 28° C.), and lengthy, but not necessarily prolonged rainfalls. Young trees may become affected while in the nursery, especially if budding material is from infected orchards, or if the rows are too close to infected orchards, or if other infected stone fruit trees are planted in the same plot.

Chemical analysis of the bark of the susceptible Chinese seedling and the resistant Elberta peach trees showed a correlation between increase in percentage of reducing sugars and the development of the disease. The indication was that reducing sugars in the bark tissues have more influence on the development of spring cankers than non-reducing sugars and nitrogen. When 1939 twigs were collected on 22nd April, 1940, the Elberta bark contained 4·7 per cent. reducing sugars and Chinese seedling 5 per cent. In the next two weeks the figures dropped to 3·7 and 2·75 per cent., respectively. Spring cankers and foliage infection were first observed on the former variety on 23rd May and on the latter on 6th May, when 92 and 93 per cent., respectively, of the sugar content was reducing sugars. In 1941 the reducing sugars in the 1940 Elberta twigs increased for three months and then decreased, but in Chinese seedling they increased steadily for five months. On 14th April spring cankers were found only in the latter, which had 34 per cent. more reducing sugar. This increase in reducing sugar may partly account for the very rapid invasion of the bark by *X. pruni* in spring, the rapidly ensuing development of extensively cankered areas and the splitting of the bark. As the developing foliage draws some of the reducing sugars from the bark, bacterial invasion of the bark ceases. Nitrogen does not appear to be a determining factor in the development of *X. pruni* in the two peach varieties examined.

Böhni (Erika). **Untersuchungen über die Bitterfäule an Kirschen.** [Studies on the bitter rot of Cherries.]—*Phytopath. Z.*, 15, 3, pp. 333–375, 34 figs., 2 diags., 4 graphs, 1949.

The writer's studies on cherry bitter rot (*Glomerella cingulata*) and on a number of related strains from Europe and North America at the Federal Technical College, Zürich [*R.A.M.*, 25, p. 400], were concerned with the forms of the pathogen, its

'chain' of infection, and the predisposition of the host [ibid., 25, p. 173] in relation to the prerequisite conditions for the development of an epiphytotic in Switzerland. The author considers that the name *G. rufomaculans* [ibid., 17, p. 506] should be retained on the grounds of priority.

It was found from comparative cultural experiments on its morphology and physiology that the causal organism segregates on its primary and secondary hosts (the former comprising grafted and wild cherry trees and the latter elder (*Sambucus nigra*), tomato, vine, apple, plum, and bean [*Phaseolus vulgaris*]) into innumerable biotypes. These differ among themselves in striking, spontaneously alternating peculiarities of development on solid and liquid media, variability of growth rate, and dissimilar nutritional requirements.

On cherries and the fruits of elder, vine, and currant, the infection 'chain' of the conidial state of the pathogen, by reason of the intra- and extramatrical segregation, falls into two independent, homogeneous, continuous cycles. The infections induced by the intramatrical segregates in the fruit stalks and branches become apparent externally, whereas those established on the leaves and buds (extramatrical) remain latent. At the same time the fungus produces on branches and bud scale remnants numerous acervuli, the overwintering reservoirs, the spores from which are transported by driving rain and raindrops from the ostioles on the surface of the stroma to the ripening fruits of primary and secondary hosts.

In consequence of characteristic skin changes brought about by mechanical growth factors, cherry varieties susceptible to bitter rot, e.g., Blaser, Hallauer Weichsel (*Prunus mahaleb*), Lauerzer, and Bähnler, reach a climax in their predisposition to infection while they are still only half-ripe, whereas in the more resistant Klöpfer, Farbkirsche, Hofkirsche, Napoleon Knorpel, Labacher, and Rieskirsche the corresponding state is not attained until full maturity. Hence in damp, warm weather the two infection cycles of the pathogen unite in the former case during the development of the fruit, and in the latter not until shortly before the harvest; in consequence of the coincidence of prerequisite conditions for epidemiology on the part of both parasite and host, the sequence of events in the infection cycle, in the manner typical of a serial disease, will bring the disease into the ascendant under optimal environmental conditions.

Control is effected by means of two post-blossom sprays with 0·75 per cent. amarex or 0·5 per cent. copper oxychloride dust+0·2 per cent. wetter, the first being applied immediately after calyx-fall and the second two to three weeks later [ibid., 27, p. 428].

Ciferri (R.). **Descrizione della probabile forma ascofora dell' Heterosporium allii Ell. & Mart. (Didymellina intermedia n. sp.).** [Description of the probable ascigerous state of *Heterosporium allii* Ell. & Mart. (*Didymellina intermedia* n.sp.).]—*Notiz. Malatt. Piante, 1949*, 2, pp. 6–7, 1949. [Mimeographed.]

In the spring of 1944, spots on sickly leaves of adult *Lilium candidum* plants in the Botanical Garden, Pavia, harboured both conidia of *Heterosporium allii* [*R.A.M.*, 25, p. 513] and perithecia of a *Didymellina*. Though the fungi were not grown in culture, it is considered probable that there is a connexion between the two. The ascomycete appears to be intermediate between *D. macrospora* [ibid., 26, p. 108], and *D. ornithogali*, but as the three conidial states are different the author considers it convenient to distinguish the corresponding ascigerous states. That on *L. candidum* appears to be distinct and the fungus is named *D. intermedia* n.sp. The perithecia were 200 to 400 by 110 to 190 μ, with a beak 40 to 95 μ long bearing a papillate ostiole. The numerous, hyaline, ovoid to fusoid-clavate asci measuring 60 to 90 by 25 to 40 μ were without paraphyses. The eight ovate, ellipsoid, or fusiform, hyaline, biseriate ascospores, 30 to 45 by 10 to 15 μ, were uniseptate, constricted at the septum, the terminal cell being larger.

Harris (R. V.) & Cadman (C. H.). **Can the health of Raspberry stocks be improved?** —*Rep. E. Malling Res. Sta., 1948*, pp. 138–140, 1 diag., 1949.

After briefly discussing virus diseases as they affect raspberry-growing [cf. *R.A.M.*, 28, pp. 340, 341], the authors put forward a plan for the production and maintenance of continuous supplies of healthy planting stock. As freedom from 'carried' or non-expressed viruses is demonstrable only by graft tests to indicator varieties, it is suggested that for each carrier type of variety provision should be made for (*a*) establishing, under strict conditions of isolation, a nuclear centre for the propagation of canes from graft-tested, virus-free plants; (*b*) regular replacement of this nuclear stock by similar tested material; and (*c*) disposal of the cane from the nuclear centre to grower-propagators responsible for the production of bulk supplies of cane. Condition of isolation for the bulk supplies could be less stringent than for the nuclear stock and would depend on the rate of infiltration of viruses from sources outside the crop. Grower-propagators would have to renew their stocks periodically with fresh supplies from the nuclear stock centre. A useful distinction might be made between stocks once grown and those twice grown from nuclear stock. This plan would ensure a regular flow of planting stock of the highest practicable grade of health and freedom from virus from the original tested source to the fruit-grower. Routine inspection would, of course, remain necessary to ensure freedom from visible infection and to guard against possible breakdown.

Wood (C. A.). **Raspberry cane nurseries.**—*Rep. E. Malling Res. Sta., 1948*, pp. 141–147, 2 figs., 1949.

The author discusses the function and advantages of special cane nurseries designed solely for the propagation of high-grade raspberry canes. Only the first-year cane is harvested annually from such nurseries. The points dealt with include varieties in relation to virus infection [see preceding abstract], the selection of plant material, choice of soil and situation, planting plan and procedure, first and second year maintenance, harvesting, manuring, inspection and roguing, and the productivity of cane nurseries. The article embodies the results of recent observations and experiments carried out mainly in Scotland.

Moore (M. H.). **Some thoughts on progress in fruit-spraying methods.**—*Rep. E. Malling Res. Sta., 1948*, pp. 153–156, 1949.

An account is given in popular terms of the development of fruit tree spraying and dusting methods from the beginning up to the present day. The subjects discussed include mobile outfits, high pressure application, frequency of treatments, the comparative effectiveness of dusting and spraying from the air and from the ground, and the use of atomized fluid concentrates.

Ten Houten (J. G.) & Kraak (M.). **A vertical spraying apparatus for the laboratory evaluation of all types of liquid pest control materials.**—*Ann. appl. Biol.*, 36, 3, pp. 394–405, 1 pl., 3 figs., 2 graphs, 1949.

The vertical spraying apparatus described in this paper is a modification of Tattersfield's, designed for the uniform application of insecticides, fungicides, and herbicides for evaluation purposes (*Ann. appl. Biol.*, 21, p. 691, 1934). The atomizing nozzle, consisting of an inner liquid-feed tube and an outer air jacket, is accurately and quickly adjustable by means of a calibrated adjusting nut, and has interchangeable tips which make it possible to spray homogeneous liquids of widely different viscosities. The air supply tube is constructed in such a way that the entering air receives a rotating movement which promotes an even spray deposit. The nozzle points vertically downwards into a cylindrical plexiglass spray chamber, 5 cm. below the lower edge of which is a splash trap consisting of a brass plate to

collect excess spray. In the centre of the brass plate is a 12 cm. hole, below which is the object table, on which the object to be sprayed is placed. A movable masking disk prevents the initial spray from reaching the object until the tower is filled with a homogeneous spray cloud. Two motor-driven, rotating disks above the object table have open sectors, the angle of which is adjustable, and through these a known dosage of spray reaches the object.

The apparatus, which has been used extensively with fungicides, will give deposits to within ± 3 per cent. of those actually required when normal aqueous solutions, oil emulsions, and straight oils are used, the figure being 5 per cent. for solutions with extreme surface activity. This degree of accuracy is obtainable at dosages as low as 10 mg. per 100 sq. cm.

Specialpræparater til bekæmpelse af plantesygdomme of skadedyr anerkendte af Statens Forsøgsvirksomhed. Gyldig for året 1949. [Special preparations for the control of plant diseases and pests approved by the State Experimental Service. Valid for the year 1949.]—*Tidsskr. Planteavl*, 53, 1, pp. 143–157, 1949.

Analyses are furnished of a number of fungicides and insecticides authorized by the Danish Plant Protection Service for use in 1949 [cf. *R.A.M.*, 27, p. 144].

Müller (J.). **Bordeauxvædskens Historie i Danmark.** [The history of Bordeaux mixture in Denmark.]—*Nord. JordbrForskn., 1948*, pp. 179–197, 1949.

This is a historical review of the literature on the application of Bordeaux mixture in Denmark for the control of (I) potato blight (*Phytophthora infestans*) and (II) apple and pear scab (*Venturia inaequalis* and *V. pirina*). A bibliography of 74 titles is appended.

Böning (K.). **Pilztötende Mittel auf organisch-synthetischer Grundlage.** [Fungicidal remedies with an organo-synthetic basis.]—*Pflanzenschutz*, 1, 12, pp. 146–147, 1949.

Up-to-date developments in the production of organo-synthetic fungicides, chiefly in the United States, are reviewed, with notes on their applications in the control of plant diseases.

Del Cañizo (J.). **Mezclas de insecticidas y anticriptogámicos.** [Mixtures of insecticides and fungicides.]—*Bol. Pat. veg. Ent. agríc., Madr.*, 16, pp. 323–336, 1 diag., 1949.

Following an introductory statement on the necessity and convenience of the use of combined fungicidal and insecticidal preparations, the principles governing compatibility and incompatibility [*R.A.M.*, 24, p. 328] between certain mixtures are briefly explained and a list is given of some standard fungicides, insecticides, and adjuvants, with indications as to the advisability or otherwise of their combination.

Common names for five fungicidal chemicals.—*Plant Dis. Reptr*, 33, 12, pp. 485–486, 1949. [Mimeographed.]

The Subcommittee on Fungicide Nomenclature of the American Phytopathological Society [*R.A.M.*, 26, p. 553; 27, p. 432], in co-operation with the Interdepartmental Committee on Pest Control, has selected the following as common names: ferbam for ferric dimethyl dithiocarbamate; ziram for zinc dimethyl dithiocarbamate; nabam for disodium ethylene bisdithiocarbamate; zineb for zinc ethylene bisdithiocarbamate; and thiram for tetramethylthiuram disulphide. Various agencies and collaborators in the United States have indicated that there is no objection to the above names and that they are considered acceptable for use.

Moore (W. C.). **The significance of plant diseases in Great Britain.**—*Ann. appl. Biol.*, 36, 3, pp. 295–306, 1 pl., 1949.

In this presidential address, delivered before the Association of Applied Biologists on 18th February, 1949, the author discusses, with many illustrative examples, the chief methods by which a more or less accurate knowledge of the economic significance of plant diseases [cf. *R.A.M.*, 29, p. 110] is gradually being built up in Britain. The significance of diseases may be studied by the slow accumulation of data about many diseases over many years, by extensive surveys of single diseases or groups of diseases carried out on a national or regional basis [ibid., 28, p. 345], and by intensive research on plot and field scale.

Since 1917 when a sub-committee of the Technical Committee of the War-Time Food Production Department inaugurated a plant disease survey of England and Wales by means of monthly reports, which contain a wealth of accumulated information second to none in the world, over 1,000 different diseases have been recorded. The author cites the 40 or 50 diseases which he considers to be the most important economically in Great Britain. These intelligence reports permit the commoner diseases to be considered in due perspective and provide a basis for sound judgement when epidemics cause alarm. For instance, when the severe outbreak of cereal take-all (*Ophiobolus graminis*) in 1948 [ibid., 28, p. 281] aroused much concern, it was possible to interpret the significance of the outbreak in the light of Garrett's researches on take-all from 1936 to 1948 at Rothamsted [ibid., 28, p. 168], and so to reassure farmers to some extent. Diseases which are increasing are brown rot of apples and pears (*Sclerotinia fructigena*), *Brassica* canker (*Phoma lingam*), and tulip grey bulb rot (*S. tuliparum*); others which may become troublesome are potato gangrene (*P. foveata*), onion leaf blotch (*Heterosporium allii* var. *cepivorum*), *Alternaria* blight of tomato (*A. solani*), and iris ink disease (*Mystrosporium adustum*) [ibid., 17, p. 797]. On the other hand, the records show that potato wart disease (*Synchytrium endobioticum*) [ibid., 28, p. 345] has now become greatly reduced and is of no real economic importance. Cucumber blotch (*Cercospora melonis*) [ibid., 21, p. 116], which almost completely destroyed the crop in north London at the beginning of the century, ceased to have any significance after the introduction of the variety Butcher's Disease Resister.

The routine intelligence work in estimating the significance of plant diseases is at present far ahead of the other two methods mentioned. Its results are purely qualitative, but they indicate which are the really important economic diseases, they serve to draw attention to new and uncommon diseases, they enable an estimate to be formed of the effects of the application of research, they can be used to direct attention to current problems, and they are always available to supplement the findings of special surveys and research.

Of the special surveys, that dealing with onion diseases from 1943–45 showed that smut (*Urocystis cepulae*) was much more generally distributed in England but much less harmful than was supposed. The survey of Yorkshire for *Didymella* stem rot of tomato (*D. lycopersici*) showed that in the peak year, 1945, 7 per cent. of the plants were involved; in 1946 and 1947 about 2 per cent. were killed.

Losses from plant diseases : effects on crop industries and on farm life.—*Plant Dis. Reptr, Suppl.* 186, pp. 254–282, 1949. [Mimeographed.]

This paper reports a valuable and detailed survey, similar to that obtained in 1934 [*R.A.M.*, 13, p. 715], of failure of crop projects due to plant diseases in the United States. Information was obtained by collaborators of the plant disease survey in 15 States, on the changes in crops caused primarily by disease, the revival of crops due to introduction of disease control, and the establishment of new diseases with new crops or by introduction [cf. ibid., 29, p. 109]. County agents, by means

of a questionnaire on the effects of plant disease losses on farm life, provided information on the losses suffered by groups of farmers and individuals in various counties, which are discussed with reference to the years 1914 to 1948.

AHMAD (T.), HASANAIN (S. Z.), & SATTAR (A.). **Some popular methods of plant disease control in Pakistan.**—*Agric. Pakistan*, 1, 1, pp. 18–22, 1949.

This survey of plant disease protection in Pakistan, most of which has already been noticed, deals with the progress made in breeding resistant sugar-cane, wheat, gram (*Cicer arietinum*), and potato varieties, crop rotation and sanitation, cultural practices, and chemical control.

In the North-West Frontier Province and West Punjab the sugar-cane variety Co 290 is least susceptible to red rot (*Colletotrichum falcatum*) [*Physalospora tucumanensis*: *R.A.M.*, 28, pp. 5, 242]. In addition to the gram variety C 62–18 [ibid., 23, p. 425], C 12–34 has been found resistant to blight (*Mycosphaerella rabiei*) and only slightly susceptible to wilt [*Fusarium orthoceras* var. *ciceri*: loc. cit.].

RAISTRICK (H.). **A region of biosynthesis.**—*Proc. roy. Soc.*, Ser. B, 136, 885, pp. 481–508, 4 pl., 1950.

In this paper, given as a Bakerian Lecture, on the relationships in chemical structure between members of representative classes of fungal metabolic products, the author deals particularly with moulds, and to a lesser extent with wood-rotting fungi, and discusses the structure and properties of their products produced in pure culture with reference to the literature. He refers to the belief that certain types of metabolites play some part in the oxidation-reduction mechanism of the moulds. He reviews the biological significance of metabolites playing a part in antibiosis [*R.A.M.*, 28, p. 189] and in conclusion states that by careful study of the metabolic products of closely related species or of strains and mutants of a single species much may be learned of the intermediate metabolism of these organisms. The 80 species mentioned in the text are listed in an appendix. There is a bibliography of 157 titles.

RODGERS (A. D.). **Liberty Hyde Bailey. A story of American plant sciences.**—506 pp., 7 pl., Princeton University Press, 1949. $7.50.

This biography of Liberty Hyde Bailey, the Cornell horticulturist, also relates the history of the development of plant science in North America, the author describing the main achievements in the United States and Canada of botanical and biological research, including plant pathology and plant breeding, during the twentieth century. Particular mention is made of the work of Erwin F. Smith. In chapter 7 (pp. 242–347) the author devotes considerable attention to the work of the Laboratories of Plant Breeding and Plant Pathology of the Bureau of Plant Industry of the United States Department of Agriculture.

DOTY (R. E.) & WISMER (C. A.). **Controlling molding of rolled Oats rat bait with chemicals.**—*Hawaii. Plant. Rec.*, 53, 2, pp. 65–73, 3 figs., 3 graphs, 1949.

In the pre-bait method of rat control used on Hawaiian sugar-cane plantations, unpoisoned rolled oats, which must be fed to rats for from five to seven days, became mouldy within four days under conditions of high humidity. Of many fungicides tested 0·4 to 0·5 per cent. powdered paranitrophenol prevented mould growth on both poisoned and unpoisoned oats and was acceptable to the rats.

DOMINIK (T.). **Przyczynek do znajomości mykorhizy u Wiąza polnego.** [Contribution to the knowledge of mycorrhiza in the field Elm.]—*Acta Soc. Bot. Polon.*, 19, 2, pp. 189–193, 1 fig., 1948. [French summary. Received December, 1949.]

The author examined elm (*Ulmus campestris*) roots and rootlets from a mixed

forest (with elm trees predominating) at Czerniejewo, near Poznań, Poland, on sandy podsol soil rich in humus (pH 5·5 to 6·6). The roots had endotrophic mycorrhiza of the thamniscophage type, i.e., the fungus formed arbuscules (H. Burgeff: Problematik der Mykorrhiza, *Naturwissenschaften*, 31, 1943). Pseudomycorrhiza were observed in older, growing roots. The mycotrophic rootlets were very rare and minute. The distribution and vigorous growth of elms in this area suggest that their association with symbiotic fungi is favourable for their development.

Whitehouse (H. L. K.). **Heterothallism and sex in the fungi.**—*Biol. Rev.*, 24, 4, pp. 411–447, 1 graph, 1949.

The literature relating to heterothallism and sex in fungi [*R.A.M.*, 28, p. 582] is critically discussed, following an introduction to the subject, under the headings of morphological heterothallism; physiological heterothallism determined by (*a*) two allelomorphs at one locus, and (*b*) multiple allelomorphs at one or two loci; significance of different types of physiological heterothallism; primary and secondary homothallism; relation between heterothallism and sex organs; significance of heterokaryosis in relation to heterothallism and sex organs; and heterothallism and evolution in the fungi. A bibliography of 154 titles is appended.

Venkataramani (K. S.). **The inhibition of the growth of fungi by certain dyestuffs. I. Some observations on the effect of malachite green on the growth of Rhizoctonia solani and on the germination of the spores of Pestalozzia theae.**—*Plant. Chron.*, 45, 1, pp. 5–10, 11 figs., 1950.

A study at the Tea Experiment Station, Nilgiris, India, of the action of malachite green [cf. *R.A.M.*, 23, p. 414; 25, p. 56; 26, p. 184] at various concentrations on the growth of *Rhizoctonia* [*Corticium*] *solani* and *Pestalotia theae* in pure culture showed that growth of the former was checked at 4 p.p.m., while germination of the spores of the latter was inhibited at 10 and 15 p.p.m.

Roland (G.). **Étude de la transmission du virus X (Solanum virus I, Orton) à la descendance végétative chez la Pomme de terre.** [Study of the transmission of virus X (*Solanum* virus I, Orton) to the vegetative progeny of Potatoes.]—*Parasitica*, 5, 4, pp. 105–109, 1949. [Flemish summary.]

Experiments carried out at Gembloux showed that tubers from potato plants of various varieties infected with virus X [*R.A.M.*, 16, p. 771], tested serologically during the 1948 growing season, were not necessarily contaminated and that very often a certain percentage, sometimes considerable (up to 100 per cent. in Ostbote and 80 per cent. in Komeet), escape infection entirely.

Plant quarantine import restrictions.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 173, pp. 100–112, 1949.

On pp. 100–112, foreign plant quarantine import restrictions concerning Bermuda, Canada, France, Germany, Great Britain, Turkey, and Venezuela are set out. A copy of a paragraph pertaining to restrictions on the entry of plant material into Germany through the mails appearing in Circular 60 of the Universal Postal Union is quoted. Articles requiring certification as free of disease include seeds, parts of plants, earth, and collections relating to plant diseases caused by parasitic fungi and bacteria. A revised summary of the plant quarantine import restrictions of Great Britain as they apply in particular to plants and plant products from the United States is given [cf. *R.A.M.*, 28, p. 368]. Certification of dried fruits is now required in Turkey and the importation of natural flowers and sugar-cane prohibited in Venezuela.